OPTICAL TRANSMISSION SYSTEM

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Abstract

PROBLEM TO BE SOLVED: To provide an optical transmission system with which signals can be transmitted at high speed between a rotating body and a fixed body while keeping the restoration accuracy of signals.
SOLUTION: Concerning this optical transmission system, the signals are transmitted between a rotating body 1 and a fixed body 2, which are contactlessly arranged, through a transmission system 3 for sending optical signals and a reception system 4 for receiving optical signals. The rotating body 1 is provided with the transmission system 3 and the fixed body 2 is provided with the reception system 4. The transmission system 3 is equipped with a laser light discharging part (light emitting part) 6 for generating a laser beam LB. The laser beam discharging part 6 is arranged at a certain position so as to discharge the optical signals at an angle turned toward a virtual point P1 determined on the central axis of the rotating body 1. The reception system 4 is equipped with a plane mirror 9 for reflecting the laser beam LB and a light receiving element 10 for receiving the laser beam LB reflected on this plane mirror 9. The plane mirror 9 is arranged at the position capable of reflecting the optical signals from the laser beam discharging part 6, and the light receiving element 10 is arranged at the convergent point of the laser beam LB determined by the mutual geometrical optical position relation between the arranging position of the plane mirror 9 and the virtual point P1.

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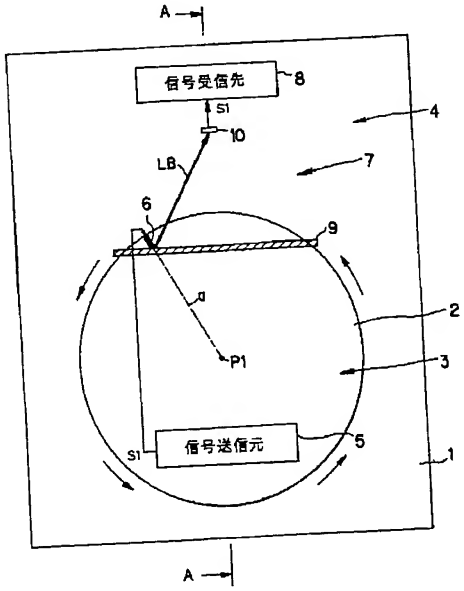
(54)【発明の名称】　光伝送システム

(57)【要約】
【課題】信号の復元精度を維持しつつ、回転体と固定体との間を高速に信号伝送できる光伝送システムを提供する。
【解決手段】光伝送システムは、非接触で配置された回転体１と固定体２の間を、光信号を送る送信系３と光信号を受ける受信系４とを介して信号伝送する。回転体１に送信系３を設け、固定体２に受信系４を設ける。送信系３はレーザ光ＬＢを発するレーザ光放出部（発光部）６を備える。レーザ光放出部６を回転体１の中心軸ＣＸ上に定めた仮想点Ｐ１に向けた角度で光信号を放出可能な位置に配置する。受信系４はレーザ光ＬＢを反射する平面鏡９と、この平面鏡９で反射されたレーザ光ＬＢを受ける受光素子１０とを備える。平面鏡９をレーザ光放出部６からの光信号を反射可能な位置に配置し、受光素子１０を平面鏡１０の配置位置及び仮想点Ｐ１の互いの幾何光学的な位置関係で定まるレーザ光ＬＢの収束点Ｐ２に配置する。



【特許請求の範囲】
【請求項１】　非接触で配置された回転体と固定体の間を、光信号を送る送信系と上記光信号を受ける受信系とを介して信号伝送する光伝送システムにおいて、上記回転体に上記送信系及び上記受信系の内の少なくとも一方を設け、上記固定体に上記送信系及び受信系の内の少なくとも他方を設けると共に、上記送信系は上記光信号を発する発光部を備え、この発光部を上記回転体の中心軸上に定めた仮想点に向けた角度で上記光信号を放出可能な位置に配置すると共に、上記受信系は上記光信号を反射する平面鏡と、この平面鏡で反射された上記光信号を受ける受光素子とを備え、上記平面鏡を上記光信号を反射可能な位置に配置し、上記受光素子を上記平面鏡を配置した位置と上記仮想点との互いの幾何光学的な位置関係で定まる上記光信号の収束点に配置したことを特徴とする光伝送システム。
【請求項２】　前記平面鏡は、複数枚の平面鏡である請求項１記載の光伝送システム。
【請求項３】　前記複数枚の平面鏡は２枚の平面鏡であり、この２枚の平面鏡の内の一方を前記発光部を配置した位置と前記仮想点との間に配置し、上記２枚の平面鏡の内の他方を上記一方と非接触で対向して配置した請求項２記載の光伝送システム。
【請求項４】　前記発光部は、複数個の発光部である請求項１乃至３のいずれか１項記載の光伝送システム。
【請求項５】　前記仮想点は、複数個の仮想点である請求項４記載の光伝送システム。
【請求項６】　前記複数個の発光部を、前記中心軸の円周方向に沿って所定の間隔で配列した請求項４記載の光伝送システム。
【請求項７】　前記複数個の発光部を、前記受光素子が光信号を前記平面鏡を介して受光可能な範囲と同じ又はその範囲よりも小さい間隔で配列した請求項４乃至６のいずれか１項記載の光伝送システム。
【請求項８】　前記受光素子は、複数個の受光素子である請求項１乃至７のいずれか１項記載の光伝送システム。
【請求項９】　前記送信系は、前記固定体に対する前記回転体の回転位置に関する位置情報を検出する検出手段と、この検出手段が検出した位置情報に基づいて前記発光部による前記光信号の発光時期を制御する制御手段とを備えた請求項８記載の光伝送システム。
【請求項１０】　前記受信系は、前記複数個の受光素子が変換した複数の電気信号を加算して出力する手段を更に備えた請求項８記載の光伝送システム。
【請求項１１】　前記受信系は、前記複数個の受光素子が変換した複数の電気信号を選択して出力する手段を更に備えた請求項８記載の光伝送システム。
【請求項１２】　前記受信系は、前記固定体に対する前記回転体の回転位置に関する位置情報を検出する検出手段と、この検出手段が検出した位置情報に基づいて前記複数個の受光素子が変換した複数の電気信号を選択して出力する手段とを更に備えた請求項８記載の光伝送システム。
【請求項１３】　前記回転体及び固定体は、Ｘ線ＣＴスキャナの架台内における診断用開口部の軸方向の位置に並設された円環状部材で成り、前記発光部を上記回転体及び固定体の内の少なくとも一方の上記軸方向の側面に設け、前記受光素子及び平面鏡を上記回転体及び固定体の内の少なくとも他方の上記軸方向の側面に設けた請求項１乃至１２のいずれか１項記載の光伝送システム。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、医用Ｘ線ＣＴスキャナの架台等に搭載される回転体と固定体の間を光信号を媒体にして信号伝送する光伝送システムに係り、とくに光学系を配置した光伝送システムに関する。
【０００２】
【従来の技術】従来、非接触で配置された回転体と固定体との間を光を媒体にして信号伝送する光伝送システムが知られている。この光伝送システムには、例えば回転運動中に連続伝送するものとして、発光素子と受光素子の位置関係などを工夫したものと、発光素子と受光素子との間に光学系を配置したものとが提案されている。以下、両者を図３４及び図３５に基づき説明する。
【０００３】まず、発光素子と受光素子を配置した光伝送システムの一例を図３４に示す。同図に示す光伝送システムは、例えば医用Ｘ線ＣＴスキャナの架台に適用したもので、この架台１００に内部において、回転部１０１の外側円周面に複数の発光素子（発光ダイオード又はレーザ等）１０２…１０２を備えるとともに、この回転部１０１の半径方向の外側の位置に固設された固定部１０３に受光素子（フォトダイオード等）１０４を備えている。発光素子１０２…１０２は、回転体１０１の円周面に沿って一定の間隔で配列されており、信号送信元１０５から信号分配部１０６を介して分配されるＸ線画像データ等の信号を回転部１０１の円周の接線方向に沿って同時に光信号として送る。
【０００４】この光伝送システムでは、少なくとも２つの隣接する発光素子１０２、１０２からの各光ビームを互いにオーバーラップさせるように発光素子１０２の配列間隔および光ビームの広がり角度を調整してあるので、回転部１０１が回転している間、複数の発光素子１０２…１０２の内の少なくとも１つの発光素子１０２から伝搬する光ビームが常に受光素子１０４で受光可能となり、ここで変換された電気信号が信号受信先１０７で元の信号に復元される。
【０００５】このタイプの光伝送システムとしては、光ビームの伝搬方向を円周の半径方向外側や回転体の軸方向に向けた角度に設定したものも提案されている（例え

ば、特開平5－253217号）。

【0006】次に、凹面鏡を配置した光伝送システムの一例（例えば、特開平5－220133号）を図35に示す。同図に示す光伝送システムも、上記と同様に医用X線CTスキャナの架台に適用したもので、この架台110の内部において、回転部111には細いビーム状のレーザ光を発振する複数のレーザ（発光素子）112…112、信号送信元113、及び信号分配部114が配置されると共に、固定部115には受光素子116及び信号受信先117のほか、凹面鏡118が設けられている。

【0007】この光伝送システムでは、回転部111が回転している間、少なくとも2つの隣接するレーザ112、112から回転部111の円周の接線方向に沿って放出されるレーザ光をある一点に固定された受光素子116に導くように凹面鏡115の曲面状態を調整してあるので、複数の発光素子112…112の内の少なくとも1つの発光素子112から放出されるレーザ光が凹面鏡115を介して受光素子114で常に受光可能となる。

【0008】

【発明が解決しようとする課題】しかしながら、上述した従来技術の光伝送システムにあっては、回転部の回転運動中に発光素子と受光素子との間の距離が変化し、光経路長（光パス長）が変化する構成であったため、光経路長が異なる複数の光信号を同時に受光した場合には、その複数の光信号間の光経路長差に基づく遅延差に起因して、信号を精度よく復元できないことがあった。

【0009】この問題は、信号の伝送周波数が高くなる程、顕著であった。これは、上述の光伝送システムは高速伝送を特に意識したものではなかったためである。また、上記問題は、回転部のサイズが大きくなる程、顕著であった。光は30cm進むのに1nsecの時間を要するため、回転部のサイズに比例して光経路長差が増加するためである。

【0010】ところで一方、医用X線CTスキャナにおいては、近年、ヘリカルスキャン方式に代表される高速スキャン技術の進歩に伴い、一度に大量に収集されるX線画像データを短時間に画像処理・表示させるため、架台内の回転体及び固定体間でX線画像データ等を高速に信号伝送することが重要となっている。

【0011】しかしながら、このように高速データ伝送（例えば、数100Mbps）を志向した医用X線CTスキャナでは、伝送される信号の復元精度上、従来の光伝送システムをそのまま適用することが困難であった。

【0012】この発明は、上述した従来技術の問題を考慮してなされたもので、信号の復元精度を維持しつつ、回転体と固定体との間を高速に信号伝送できる光伝送システムを提供することを、目的とする。また、高速伝送を志向したX線CTスキャナに最適な光伝送システムを提供することを、別の目的とする。

【0013】

【課題を解決するための手段】上記目的を達成するため、請求項1記載の光伝送システムは、非接触で配置された回転体と固定体の間を、光信号を送る送信系と上記光信号を受ける受信系とを介して信号伝送する構成とし、上記回転体に上記送信系及び上記受信系の内の少なくとも一方を設け、上記固定体に上記送信系及び受信系の内の少なくとも他方を設けると共に、上記送信系は上記光信号を発する発光部を備え、この発光部を上記回転体の中心軸上に定めた仮想点に向けた角度で上記光信号を放出可能な位置に配置すると共に、上記受信系は上記光信号を反射する平面鏡と、この平面鏡で反射された上記光信号を受ける受光素子とを備え、上記平面鏡を上記光信号を反射可能な位置に配置し、上記受光素子を上記平面鏡の配置位置及び上記仮想点の互いの幾何光学的な位置関係で定まる上記光信号の収束点に配置している。

【0014】請求項2記載の発明では、前記平面鏡は複数枚の平面鏡である。

【0015】請求項3記載の発明では、前記複数枚の平面鏡は2枚の平面鏡であり、この2枚の平面鏡の内の一方を前記発光部を配置した位置と前記仮想点との間に配置し、上記2枚の平面鏡の内の他方を上記一方と非接触で対向して配置している。

【0016】請求項4記載の発明では、前記発光部は複数個の発光部である。

【0017】請求項5記載の発明では、前記仮想点は複数個の仮想点である。

【0018】請求項6記載の発明では、前記複数個の発光部を前記中心軸の円周方向に沿って所定の間隔で配列している。

【0019】請求項7記載の発明では、前記複数個の発光部を前記受光素子が光信号を前記平面鏡を介して受光可能な範囲と同じ又はその範囲よりも小さい間隔で配列している。

【0020】請求項8記載の発明では、前記受光素子は複数個の受光素子である。

【0021】請求項9記載の発明では、前記送信系は、前記固定体に対する前記回転体の回転位置に関する位置情報を検出する検出手段と、この検出手段が検出した位置情報に基づいて前記発光部による前記光信号の発光時期を制御する制御手段とを備えている。

【0022】請求項10記載の発明では、前記受信系は、前記複数個の受光素子が変換した複数の電気信号を加算して出力する手段を更に備えている。

【0023】請求項11記載の発明では、前記受信系は、前記複数個の受光素子が変換した複数の電気信号を選択して出力する手段を更に備えている。

【0024】請求項12記載の発明では、前記受信系は、前記固定体に対する前記回転体の回転位置に関する

位置情報を検出する検出手段と、この検出手段が検出した位置情報に基づいて前記複数個の受光素子が変換した複数の電気信号を選択して出力する手段とを更に備えている。

【００２５】請求項１３記載の発明では、前記回転体及び固定体は、Ｘ線ＣＴスキャナの架台内における診断用開口部の軸方向の位置に並設された円環状部材で成り、前記発光部を上記回転体及び固定体の内の少なくとも一方の上記軸方向の側面に設け、前記受光素子及び平面鏡を上記回転体及び固定体の内の少なくとも他方の上記軸方向の側面に設けている。

【００２６】

【発明の実施の形態】最初に、以下の各実施形態に共通する本発明に係る光伝送システムの原理を図１～図４に基づき説明する。

【００２７】図１は、同一面内に配置されたｎ個のレーザＬｘ（ｘ＝１、２、３、…、ｎ（以下同じ））を想定し、各レーザＬｘが配置された位置から仮に定めた１点（以下、「仮想点」と呼ぶ）Ｐ１に向けてレーザ光を放出させ、各レーザ光を平面鏡Ｍ１で反射させたときの光反射経路及び光経路長を説明するものである。

【００２８】同図に示すように、平面鏡Ｍ１に入射した各レーザ光は、幾何光学的な光線の直進及び反射法則により、いずれの入射位置Ｒｘにあっても常に、平面鏡Ｍ１を挟んで仮想点Ｐ１と面対称となる１点（以下、「収束点」と呼ぶ）Ｐ２に向かう角度で反射する。従って、各レーザＬｘから収束点Ｐ２までの各光経路長をｄｘとし、線分ＬｘＲｘの各長さをａｘとし、線分ＲｘＰ２の各長さをｂｘとし、線分ＲｘＰ１の各長さをｃｘとしたときに、ｂｘ＝ｃｘとなることから、光経路長ｄｘは、

【数１】ｄｘ＝ａｘ＋ｃｘ＝ａｘ＋ｂｘ　……（１）

の式で表現される。即ち、光経路長ｄｘは、平面鏡Ｍ１がないとしたときの仮想点Ｐ１までの光経路長と等しい。

【００２９】従って、本発明では仮想点と平面鏡との互いの幾何光学的な位置関係に基づく収束点が必ず存在することと、その収束点までの光経路長が平面鏡がないとしたときの仮想点までの光経路長と等しいことに着目した。

【００３０】上記の位置関係は、１枚の平面鏡を配置した例であるが、複数枚の平面鏡を配置した場合にも同様に成立する。例えば、図１に示すように、平面鏡Ｍ１と収束点Ｐ２の間に別の平面鏡Ｍ２を配置すると、平面鏡Ｍ２に入射した各レーザ光は、平面鏡Ｍ２を挟んで収束点Ｐ２と面対称となる新たな収束点Ｐ３に向かう角度で反射する（図１中の二点鎖線参照）。従って、収束点Ｐ３までの各光経路長は、平面鏡Ｍ２がないとしたときの収束点Ｐ２までの各光経路長ｄｘ、即ち平面鏡Ｍ１もないとしたときの仮想点Ｐ１までの各光経路長と等しい。

【００３１】上記の位置関係は、同一面内に配置したレーザの例であるが、図２に示すように、空間内に配置された複数のレーザＬｘについても同様に成立する。この位置関係を図３に基づいて検討してみる。

【００３２】まず、図３に示すＸＹＺ空間内に２つのレーザＬ１、Ｌ２を配置し、その各レーザＬ１、Ｌ２の向きを点（仮想点）Ｐ１に向けた角度とし、その各レーザＬ１、Ｌ２と仮想点Ｐ１の間のＸＹ平面上に平面鏡Ｍを配置したとする。

【００３３】ここで、平面鏡Ｍに入射する光の方向の各単位ベクトルＡ１、Ｂ１を、

【数２】Ａ１＝（ａ１，ａ２，ａ３）　……（２）

【数３】Ｂ１＝（ｂ１，ｂ２，ｂ３）　……（３）

の座標で表し、この各単位ベクトルＡ１、Ｂ１の延長線の交点、即ち点Ｐ１を、

【数４】Ｐ１＝（ｐ１，ｐ２，ｐ３）　……（４）

の座標で表したときに、平面鏡Ｍで反射した光の方向の各単位ベクトルＡ２、Ｂ２は、

【数５】Ａ２＝（ａ１，ａ２，－ａ３）　……（５）

【数６】Ｂ２＝（ｂ１，ｂ２，－ｂ３）　……（６）

の座標となる。従って、上述の（２）～（６）から、各単位ベクトルＡ２、Ｂ２の延長線は点Ｐ２（収束点）で交わると共に、この点Ｐ２は、

【数７】Ｐ２＝（ｐ１，ｐ２，－ｐ３）　……（７）

の座標となることから、上述の収束点および光経路長に関する着目点が空間内に配置したレーザ及び任意の角度に配置した平面鏡について成立する。つまり、レーザの向きは仮想点に向けた角度であれば任意の角度でよく、そのレーザに対する平面鏡の向きも光を入射可能な状態であれば任意の角度でよい。また、複数枚の平面鏡を用いて光を複数回反射させる場合も同様である。

【００３４】以上の着目点は、レーザの位置を移動させても、仮想点に向けた角度を維持している限り、同様に成立する。特に、レーザと仮想点との間の距離を一定に維持させた状態でレーザを移動させると、収束点の位置が変化しないだけでなく、その収束点までの光経路長も一定となる。例えば、図４に示すように、レーザＬ１を仮想点Ｐ１を中心とする円周方向に沿って移動させる条件を考えると、各移動位置Ａｘから平面鏡Ｍに入射されたレーザ光は、常に収束点Ｐ２に向かう角度で反射すると共に、収束点Ｐ２までの各光経路長は、常に仮想点Ｐ１までの光経路長、即ち半径ｒを維持する。

【００３５】以下、この発明の実施形態を順次説明する。

【００３６】（第１実施形態）まず、この発明の第１実施形態を図５～図８に基づいて説明する。この第１実施形態に係る光伝送システムは、上述の発明の原理に基づく最も基本的なもので、例えば医用Ｘ線ＣＴスキャナに適用可能なものである。

【００３７】図５は、光伝送システムを搭載した回転体１及び固定体２の配置状況を説明するものである。同図

に示す如く、回転体1はその中心軸ＣＸに開口部（以下の各図面では便宜上省略）を有する円環状部材等から成り、固定体2は回転体1を回動自在に支持するハウジング内のフレーム部材等から成る。

【００３８】図6及び図7に示す光伝送システムは、回転体1に光信号を送る送信系3を配置し、固定体2に光信号を受ける受信系4を配置した構成で、回転体1から固定体2への光を媒体にした信号伝送を行うものである。

【００３９】送信系3は、伝送用の信号Ｓ1を供給する信号送信元5と、この信号送信元5からの信号Ｓ1を光信号に変換してビーム状のレーザ光ＬＢとして放出するレーザ光放出部（本発明の発光部を成す）6とを備えている。

【００４０】レーザ光放出部6は、例えばレーザダイオード等のレーザから成るもので、回転体1の軸方向の側面に固設されている。このレーザ光放出部6では、レーザ光ＬＢの放出角度（ビームの中心線の方向）が中心軸ＣＸ上に定めた仮想点Ｐ1に向かう角度に設定されている。（図8中の符号ａ、ｂ、ｃ参照）。即ち、レーザ光放出部6と仮想点Ｐ1との位置関係は、直円錐の底面円周部と頂点との位置関係と等価となる。従って、このレーザ光放出部6は、回転体1が回転している間、常時、仮想点Ｐ1に向かう一定の角度でビーム状のレーザ光ＬＢを放出する。

【００４１】受信系4は、レーザ光放出部6からレーザ光ＬＢを電気信号に変換して受ける受光部7と、この受光部7で変換された電気信号を元の信号Ｓ1に変換（復元）する信号受信先8とを備えている。

【００４２】受光部7は、レーザ光放出部6からのレーザ光を反射する平面鏡9と、この平面鏡9で反射されたレーザ光を受ける受光素子１０とを備えている。

【００４３】平面鏡9は、レーザ光放出部6と仮想点Ｐ1の間に配置されるもので、その反射面が回転体1の軸方向に平行な角度で固定体1に固設されている。この平面鏡9は、レーザ光放出部6が所定の回転位置（以下、便宜上、「受光位置」と呼ぶ）にあるときにレーザ光ＬＢを入射し、これを受光素子１０側に反射する。

【００４４】受光素子１０は、例えばフォトダイオードから成るもので、平面鏡9が配置された位置と仮想点Ｐ1との互いの位置関係で定まる上述の収束点Ｐ2に配設される。受光素子１０で変換された微弱な電流信号は信号受信先8に出力される。

【００４５】次に、この実施形態の全体の作用を説明する。

【００４６】まず、固定体2に対し回転体2がその中心軸ＣＸを中心に回転し、これに伴ってレーザ放出部6が受光部7に対して回転したとする。この状態で、信号送信元8からの信号がレーザ光放出部6で光信号に変換されてレーザ光ＬＢとして仮想点Ｐ1に向かう角度で放出される。

【００４７】ここで、レーザ放出部6が受光位置にあるときは、レーザ光ＬＢが平面鏡9を介して収束点Ｐ2に配置された受光素子１０で受光可能となる。このとき、レーザ光ＬＢの光経路長は、平面鏡9がないとしたときの仮想点Ｐ1までの距離と等しく、レーザ光放出部6の位置に関係なく常に一定である。

【００４８】従って、レーザ放出部6が回転している間に平面鏡9に入射されるレーザ光ＬＢは、常に受光素子１０に導かれると共に、その光経路長もレーザ光放出部6の位置に関係なく常に一定であることから、受光素子9が遅延差のある信号を受ける事態が殆ど回避されるようになる。これにより、信号の復元精度を維持しつつ、信号の伝送周波数を高めることができ、高速伝送化を図ることが可能となる。

【００４９】また、二次的には、光学系に平面鏡を採用したため、例えば従来の複雑で且つ比較的高価な凹面鏡と比べ、容易に且つ比較的安価に製作できるといった利点もある。

【００５０】なお、この実施形態では、ビーム状のレーザ光を使用してあるが、この発明はこれに限定されるものではなく、コーン状等の一定の広がり角をもつ光ビームでもよい。従って、発光部はレーザを用いた構成に限定されるものではなく、光ビームを発する発光ダイオード等の発光素子を用いた構成でもよい。

【００５１】また、この実施形態の応用例として、固定体に対する回転体の位置情報を検出する検出手段（センサを要部とする）と、この検出手段が検出した位置情報に基づいて、例えばレーザ光放出部の回転位置が光信号を受光部に伝送可能な受光位置にあるときに光信号を送るように、信号送信元からレーザ光放出部への信号供給・停止の駆動タイミングを制御する制御手段とを回転体に加えてもよい。

【００５２】また、別の応用例として、回転体の停止位置を予め受光位置に設定し、この回転体が停止したときに信号伝送を行う構成を加えてもよい。

【００５３】（第2実施形態）次に、この発明の第2実施形態を図9及び図１０に基づき説明する。この第2実施形態は、上述の受光部に2枚の平面鏡を配置したものである。ここで、上記第1実施形態と同一又は同等の構成要素については同一又は同等の符号を付してその説明を簡略又は省略する。

【００５４】図9及び図１０に示す光伝送システムは、回転体1に送信系3を配置し、固定体2に受信系4を配置した構成で、送信系3と受信系4とを介して回転体1から固定体2への信号伝送を行うものである。送信系3は1つのレーザ光放出部6を備え、受信系4は1つの受光部7を備える。

【００５５】受光部7は、2枚の平面鏡9、9及び1個の受光素子１０を備え、2枚の平面鏡9、9を回転体1

の中心軸ＣＸの半径方向の異なる位置に対向して並設し、その２枚の平面鏡９、９の位置と仮想点Ｐ１との位置関係で定まる収束点Ｐ２に受光素子１０を配置して形成されている。

【００５６】ここで、レーザ光放出部６が受光位置にあるときは、２枚の平面鏡９、９で反射されるレーザ光ＬＢは常に受光素子１０に導かれ、その光経路長も常に一定の値、即ちレーザ光放出部６と仮想点Ｐ１との間の距離と等しい。

【００５７】従って、この実施形態では、上記第１実施形態と同等の効果に加え、受光部の配置に要する架台内スペース、特に架台の半径方向のスペースを各段に小さくできることから、医用Ｘ線ＣＴスキャナの架台をコンパクトに構築できる利点がある。

【００５８】（第３実施形態）次に、この発明の第３実施形態を図１１及び図１２に基づいて説明する。この第３実施形態に係る光伝送システムは、複数のレーザ光放出部と１つの受光部を配置して連続伝送を図るものである。ここで、上記第１実施形態と同一又は同等の構成要素については同一又は同等の符号を付してその説明を簡略又は省略する。

【００５９】図１１及び図１２に示す光伝送システムは、回転体１に送信系３を配置し、固定体２に受信系４を配置した構成で、送信系３と受信系４を介して回転体１から固定体への信号伝送を行うものである。受信系４は、上記第１実施形態と同等の１つの受光部７に平面鏡９及び受光素子１０を備える。

【００６０】送信系３は、信号Ｓ１を供給する信号送信元５と、回転体１の外側円周部に一定間隔で配列した複数、例えば６つのレーザ光放出部６…６と、信号送信元５からの信号Ｓ１を複数のレーザ放出部６…６に分配する信号分配部１１を備えている。

【００６１】信号分配部１１は、所定の信号分配回路から成るもので、信号送信元５からシリアルに供給される信号Ｓ１をそのままレーザ放出部６…６の個数に応じて分配し、これを各レーザ放出部６…６に個別に供給する。

【００６２】レーザ光放出部６…６は、複数（例えば６個）のレーザを回転体１の円周方向に一定間隔で配置して成るもので、レーザ光ＬＢ…ＬＢの放出方向が全て仮想点Ｐ１に向かう角度に設定されている。このレーザ光放出部６…６の配列間隔は、回転体１から固定体２への連続伝送を行うために、受光部７がレーザ光を受光可能な範囲と等しく又はその範囲よりも小さく設定することが望ましい。

【００６３】このため、回転体１が固定体２に対して回転している間、複数のレーザ光放出部６…６からの複数のレーザ光ＬＢ…ＬＢの内の少なくとも１つが平面鏡１０を介して受光素子９で受光可能となる。

【００６４】従って、この実施形態では、上記第１実施形態と同等の効果に加え、回転体から固定体への信号の連続伝送を行うことができる利点がある。

【００６５】なお、この実施形態では、複数のレーザ光放出部６…６に個別にレーザを配置した構成としてあるが、この発明は必ずしもこれに限定されるものではない。

【００６６】例えば、１個のレーザを信号分配部１１に配置し、その信号分配部１１にレーザ光放出部６…６の数に応じた複数の光ファイバを接続し、光を媒体とした伝送信号を信号分配部１１から各光ファイバを介して各レーザ光放出部６…６に個別に供給し、その光ファイバの先端部からレーザ光を直接的に又はレンズ等の光学系を介して間接的に放出させる構成であってもよい。この場合、信号の伝送周波数によっては、レーザ光放出部６…６の全てを同時に発光させるため、信号分配部１１からレーザ光放出部６…６までの各光ファイバの経路長を全て等しくすることが望ましい。

【００６７】（第４実施形態）次に、この発明の第４実施形態を図１３～図１６に基づき説明する。この第４実施形態に係る光伝送システムは、複数のレーザ光放出部と複数の受光部を配置したものである。ここで、上記各実施形態と同一又は同等の構成要素については同一又は同等の符号を付してその説明を簡略又は省略する。

【００６８】図１３及び図１４に示す光伝送システムは、回転体１に送信系３を配置し、固定体２に受信系４を配置した構成で、送信系３と受信系４を介して回転体１から固定体２への信号伝送を行うものである。また、この光伝送システムには、固定体２に対する回転体１の回転位置を検出する回転位置検出系２０が回転体１に備えられている。

【００６９】受信系４は、回転体１の中心軸ＣＸを挟んで対向する位置（中心軸を中心とする１８０度の角度位置）に２つの受光部７ａ、７ｂを備え、その２つの受光部７ａ、７ｂの夫々に平面鏡９及び受光素子１０を備える。

【００７０】送信系３は、２つの伝送信号Ｓ１、Ｓ２を独立した経路で供給する信号送信元５と、上記第３実施形態と同等の複数個（例えば６個）のレーザ光放出部６…６と、信号送信元５からの伝送信号Ｓ１、Ｓ２を各レーザ放出部６…６に分配する信号分配部１１とを備える。

【００７１】信号分配部１１は、図１５に示すように、信号送信元５からパラレルに供給される２つの信号Ｓ１、Ｓ２の内のいずれか一方を各レーザ光放出部６…６に個別に分配して供給するもので、２つの信号Ｓ１、Ｓ２を切り換えるための信号切換部１２を備えている。

【００７２】信号切換部１２は、例えばマルチプレクサ等の切換スイッチから成るもので、回転位置検出系２０からの制御信号に基づいて、各レーザ光放出部６…６毎に与える２つの信号Ｓ１、Ｓ２の供給開始、停止、切換

えに関するスイッチ動作を行う。

【００７３】回転位置検出系２０は、図１６に示すように、回転体１の外側円周部に対向する固定体２の内周面に円周方向に一定間隔で配置された複数のプレート２１…２１と、このプレート２１…２１を横切るように回転体１の外側円周部に配置された位置情報検出用の光センサ等のセンサ２２と、このセンサ２２の位置情報を監視する角度監視部２３とを備えている。

【００７４】センサ２２は、回転体１が回転中に固定体２に配置される複数のプレート２１…２１を横切ることで、このプレート数に比例した分解能で固定体２に対する回転体１の位置情報を検出し、これを角度監視部２３に出力する。

【００７５】角度監視部２３は、センサ２２からの検出信号に基づいて、各レーザ光放出部６…６が回転中に、例えば一方の受光部７ａでは常に一方の信号Ｓ１だけを受光し、他方の受光部７ｂでは他方の信号Ｓ２だけを受光するように、各レーザ光放出部６…６に与える信号Ｓ１、Ｓ２の供給開始、その停止、及び切り換え時期に関する制御信号を信号分配部１２に供給する。

【００７６】このため、回転体１が固定体２に対して回転している間、信号送信元５から供給される一方の信号Ｓ１は常に一方の受光部７ａで受光されると共に、他方の信号Ｓ２も常に他方の受光部７ｂで受光される。

【００７７】従って、この実施形態では、上記第１実施形態と同等の効果に加え、固定体に対する回転体の回転位置に応じて、信号送信元からの複数の信号の内の所定の信号が所定の受光部で常に受光されるため、複数の信号を連続して同時にパラレル伝送できる利点がある。

【００７８】なお、この実施形態では、回転位置検出系にプレート及びセンサを採用してあるが、この発明では必ずしもこれに限定されるものでなく、エンコーダ等を用いた構成でもよい。

【００７９】また、この実施形態では、回転体に回転位置検出系を設けてあるが、この発明は必ずしもこれに限定されるものではなく、固定体に回転位置検出系を設けてもよい。この場合、固定体にセンサ、回転体にプレートを配置し、固定体側で回転角度を検出すればよい。また、固定体の回転機構に搭載した駆動モータにエンコーダを付けて、その駆動モータの回転位置をエンコーダで検出することで、回転体の回転角度を測定してもよい。

【００８０】（第５実施形態）次に、この発明の第５実施形態を図１７～図１９に基づき説明する。この第５実施形態に係る光伝送システムは、複数のレーザ光放出部と複数の受光部を配置したものである。ここで、第１実施形態と同一又は同等の構成要素については、同一又は同等の符号を付してその説明を簡略又は省略する。

【００８１】図１７及び図１８に示す光伝送システムは、回転体１に送信系３を配置し、固定体２に受信系４を配置した構成で、送信系３と受信系４を介して回転体１から固定体２への信号伝送を行うものである。また、この光伝送システムには、固定体２に回転位置検出系２０が備えられている。

【００８２】回転位置検出系２０は、上記第４実施形態と同等のプレート（図示しない）を回転体に配置し、上記第４実施形態と同等のセンサ２２及び角度監視部２３を固定体に配置して成るもので、角度監視部２３による制御信号を受信系４に供給する。

【００８３】受信系４は、回転体１の外側円周部に一定間隔（例えば中心軸ＣＸを中心とする１２０度）に配置された３つの受光部７ａ、７ｂ、７ｃと、この各受光部７ａ…７ｃで変換された微弱な電流信号を受ける信号受信先８とを備える。

【００８４】信号受信先８は、図１９に示すように、角度監視部２３からの制御信号に基づいて、３つの受光部７ａ…７ｃの内の指示された受光部を選択し、その受光部からの信号を受信信号に切り換えるマルチプレクサ等の切換スイッチから成る信号切換部１３を備える。

【００８５】送信系３は、信号Ｓ１を供給する信号送信元５と、回転体１の中心軸ＣＸを挟む位置に対向配置された２つのレーザ光放出部６、６と、信号送信元５からの信号Ｓ１を同時に２つのレーザ放出部６、６に分配する信号分配部１１とを備えている。レーザ光放出部６、６の配列間隔は、１つの受光部がレーザ光ＬＢを受光可能な範囲よりも大きく設定されている。

【００８６】このため、回転体１が回転している間、２つのレーザ光放出部６、６からのレーザ光ＬＢ、ＬＢの内の少なくとも一方が３つの受光部７ａ…７ｃの内の少なくとも１つで受光可能となり、その受光可能な受光部で変換された微弱な電流信号のみが常に受信信号として選択され、元の信号Ｓ１に復元される。

【００８７】従って、この実施形態では、上記第４実施形態と同等の効果に加え、連続伝送に必要なレーザ光放出部の数を削減できる利点がある。

【００８８】なお、この第５実施形態の応用例として、３つの受光部７ａ…７ｃに個別に２枚の平面鏡９、９を配置した場合を図２０及び図２１に示す。この場合には、受光部に要するスペースを小さくでき、装置自体をコンパクトに構築できる利点がある。

【００８９】（第６実施形態）次に、この発明の第６実施形態を図２２～図２４に基づき説明する。この第６実施形態に係る光伝送システムは、複数のレーザ光放出部と複数の受光部を配置したものである。ここで、上記各実施形態と同一又は同等の構成要素については同一又は同等の符号を付してその説明を簡略又は省略する。

【００９０】図２２及び図２３に示す光伝送システムは、回転体１に送信系３を配置し、固定体２に受信系４を配置した構成で、送信系３と受信系４を介して回転体１から固定体２への信号伝送を行うものである。送信系３は上記第３実施形態と同等の構成である。

【００９１】受信系４は、上記第４実施形態と同等の２つの受光部７ａ、７ｂと、両受光部７ａ、７ｂで変換された微弱な電流信号を受ける信号受信先８とを備え、信号受信先８には、２つの受光部７ａ、７ｂから個別に入力される信号の内のいずれか一方を選択して出力させる信号選択回路３０が備えられている。

【００９２】信号選択回路３０は、図２４に示すように、２つの受光部７ａ、７ｂの夫々の出力側に個別に接続されるエラー監視回路３１、３１と、このエラー監視回路３１、３１からの制御信号を受けて動作するスイッチコントロール回路３２と、このスイッチコントロール回路３２からの制御信号に基づいて、受信信号を切り換えるマルチプレクサ等の切換スイッチから成る信号切換部３３とを備えた構成で、伝送エラーが発生した場合に、伝送エラーが発生していない側の信号を選択し、これを受信信号として出力させるようになっている。

【００９３】エラー監視回路３１は、例えば所定期間内に受信があるか否かを判定し、その判定結果に応じて伝送エラーの発生有無を検出する回路、又は、ＣＲＣ（CyclicRedundancy Check ）等の符号照合方式を採用した伝送誤り検出回路から成るもので、伝送エラーの発生有無に関する制御信号をスイッチコントロール回路３２に供給する。

【００９４】従って、この実施形態では、上記各実施形態と同等の効果に加え、信号伝送経路を２重化したため、例えばレーザ光放出部や受光素子の故障やアライメントのずれに対処でき、これにより、システムの伝送信頼性が大幅に向上するようになる。

【００９５】なお、この実施形態の応用例として、信号送信先に信号加算回路を設け、その信号加算回路で加算された信号を受信信号とする回路構成を採用してもよい。この信号加算回路の一例を図２５に示す。

【００９６】図２５に示す信号加算回路４０は、２個のフォトダイオード（受光素子）１０、１０の出力側に電流ー電圧変換アンプ４１及びコンパレータ４２を備える。

【００９７】電流－電圧変換アンプ４１は、例えば演算増幅器とフィードバック抵抗Ｒｆを搭載したＩ－Ｖ変換器から成るもので、各フォトダイオード１０、１０で変換された微弱な電流信号Ｉｓ１、Ｉｓ２を加算した電流信号（Ｉｓ１＋Ｉｓ２）を電圧信号Ｖｓ（Ｖｓ＝Ｒｆ（Ｉｓ１＋Ｉｓ２））に変換してコンパレータ４２に出力する。

【００９８】コンパレータ４２は、例えば演算増幅器を搭載した比較回路から成るもので、電流ー電圧変換アンプからの出力電圧Ｖｓと基準電圧Ｖｒｅｆを互いに比較し、その比較結果の大小に応じたデジタル量の電圧信号Ｖを受信信号として出力するようになっている。

【００９９】なお、この応用例では複数の受光部からの各信号を加算して出力する構成としたが、例えば受光部が１つの場合には、フォトダイオードを１つにして同様にデジタル信号を取り出すことができる。この場合、信号加算回路を受光部に一体に搭載してもよい。また、信号加算回路は、フォトダイオードからの電気信号をデジタル信号に変換してから論理加算回路で加算する構成であってもよい。

【０１００】（第７実施形態）次に、この発明の第７実施形態を図２６～図２８に基づいて説明する。この第７実施形態は、回転体から固定体への信号伝送を行う光伝送システムを医用ＣＴスキャナの架台に搭載して実施したものである。ここで、上記第１～６実形態と同一又は同等の構成要素については、同一又は同等の符号を付してその説明を簡略又は省略する。

【０１０１】図２６に示す架台５０及び寝台６０を搭載した医用Ｘ線ＣＴスキャナにおいては、被検者Ｐを載せた寝台６０が架台５０の診断用開口部Ｋの軸方向に移動し、この診断用開口部Ｋで被検者ＰのＸ線ＣＴ撮影が行なわれている。このとき、架台５０の内部において、診断用開口部Ｋの軸方向の異なる位置に回転体１と固定体２とが並設されており、この両者１、２の間で光伝送システムを介してＸ線画像データ等の伝送が光信号を媒体にして連続的に行われる。また、両者１、２間の信号伝送に関しては、上記光伝送システムのほか、電力及び信号伝送用のスリップリング（例えば、東芝レビュー　１９９４　Ｖｏｌ．４９　Ｎｏ．１２）６０に代表されるシステムも装備されている。

【０１０２】回転体１は、断面Ｕ字状に一体に又は個別に成形された円環状部材からなる回転部フレームから成るもので、ベアリング５１を介して固定体２に回動自在に支持されている。この回転体１は、架台５０内のベルト伝動に代表されるモータ駆動機構（図示しない）により、その中心軸ＣＸを中心にして回転するようになっている。

【０１０３】この回転体１には、その軸方向の寝台側側面にＸ線ＣＴ撮影に関する複数の回転部ユニット５２…５２が取り付けられている。この回転部ユニット５２…５２には、図２７に示すように、診断用開口部Ｋに挿入された被検者Ｐを挟む位置に対向配置された管球（Ｘ線管）５２ａおよび検出器５２ｂのほか、管球５２ａに高電圧を供給する高電圧発生装置５２ｃ、Ｘ線のビーム形状調整用のスリットユニット５２ｄ、管球冷却用のオイルクーラー５２ｅ、上記検出器５２ｂで検出された微小な電流信号を増幅・Ａ／Ｄ変換するＤＡＳ（「データ収集システム」）５２ｆ、これらユニット５２ａ…５２ｆの動作を総括する回転部制御ユニット５２ｈ等が含まれる。

【０１０４】固定体２は、断面逆Ｔ字状の円環状部材からなる固定部フレームから成るもので、回転体１の半径方向外側に配置されている。この固定体２には、Ｘ線ＣＴ撮影に関する固定部ユニット、例えば信号受信部５３

が取り付けられている。

【０１０５】光伝送システムは、上述の回転体１及び固定体２の間を光を媒体にして信号伝送するもので、図２６及び図２８に示すように、前記各実施形態と同等の光伝送構成、即ち回転体１に送信系３を配置し、固定体２に受信系４を配置して成るものである。この光伝送システムを架台５０内の背面側位置に配置した理由は、回転部ユニット５３…５３、特に高電圧発生装置等からのノイズを避けると共に、例えば特定のユニットを他のユニットの奥側に配置したときにメンテナンスが悪くなる等の部品配置上の問題を考慮に入れたためである。

【０１０６】送信系３は、上記第３～第６実施形態と同等の信号送信元５および信号分配部１１を回転体１に配置されたＤＡＳ５２ｆ内に一体に搭載すると共に、上記第３実施形態に代表される複数のレーザ光放出部６…６を回転体１の固定体２側の側面の円周方向に一定間隔で配列して形成されている。

【０１０７】受信系４は、上記第２実施形態に代表される受光部７及び信号受信先８を備え、受光部７を固定体１の回転体２側の側面に取り付けると共に、信号受信先８を信号受信部５３内に一体に搭載している。

【０１０８】このため、回転体１が回転している間、各レーザ光放出部６…６から放出されるレーザ光ＬＢ…ＬＢの内の少なくとも１つは、常に２枚の平面鏡９、９を介して受光素子で受光され、その光経路長も常に等しい。

【０１０９】従って、この実施形態でも、上記各実施形態と同等の効果、即ち遅延差のない光を連続して受光できるので、例えばＸ線画像データ等の信号をより一層高速に伝送することが可能となる。

【０１１０】（第８実施形態）次に、この発明の第８実施形態を図２９及び図３０に基づき説明する。この第７実施形態は、上記各実施形態の光伝送構成とは逆に、固定体から回転体へのデータ伝送を行う光伝送システムに適用したものである。ここで、上記各実施形態と同一又は同等の構成要素については、同一又は同等の符号を付してその説明を簡略又は省略する。

【０１１１】図２６及び図２７に示す光伝送システムは、回転体１に受信系４を配置し、固定体２に送信系３を配置した構成で、送信系３と受信系４を介して固定体２から回転体１への信号伝送を行うものである。即ち、送信系３は、上記第３実施形態と同等の信号送信元５、複数のレーザ光放出部６…６、及び信号分配部１１を固定体１に配置し、受信系４は、上記第２実施形態と同等の受光部７及び信号受信先８を回転体１に配置している。

【０１１２】このため、回転体１が回転している間、固定体１に配置された各レーザ光放出部６…６からのレーザ光ＬＢ…ＬＢの内の少なくとも１つが、回転体１に配置された平面鏡９で反射され、受光素子１０で受光可能となる。

【０１１３】従って、この実施形態では、上記第３実施形態と同等の効果に加え、固定体から回転体への連続した信号伝送を行うことができる。

【０１１４】なお、固定体から回転体への光伝送構成は、この実施形態に限定されるものではなく、上記各実施形態と逆の光伝送構成が全て適用可能である。また、送信系及び受信系を回転体及び固定体の両方に配置することで双方向の信号伝送も可能となる。

【０１１５】例えば、前記第７実施形態に係る光伝送システムでは、固定体から回転体への信号伝送をスリップリングを用いたシステムで行う構成としてあるが、このスリップリングに代えて、この第８実施形態に代表される光伝送システムを搭載することで、双方向の信号伝送が可能となる。

【０１１６】また、上記第１～第８実施形態に係る光伝送システムは、医用Ｘ線ＣＴスキャナの架台等に適用してあるが、この発明は必ずしもこれに限定されるものではない。例えば、核医学診断装置（ＰＥＴ、ＳＰＥＣＴ）等の回転するもので軸の位置に制限があり、比較的サイズが大きなもので、高速伝送が要求されるもの等に十分適用できる。

【０１１７】また、複数のレーザ光放出部については、必ずしも同じ円周方向に沿って所定の間隔で配列させる必要はなく、仮想点に向かう角度で光信号を放出可能な位置であれば、例えば半径方向の異なる位置や軸方向の異なる位置などの任意の位置に設けてもよい。

【０１１８】また、上記第１～第８実施形態に係る光伝送システムは、図３１に示すように、回転体の軸方向に平行に配置した１枚の平面鏡で１回反射させる方式（同図（ａ）参照）、又は、回転体の軸方向に平行に配置した２枚の平面鏡で少なくとも１回づつ反射させる方式（同図（ｂ）参照）を採用してあるが、この発明はこれに限定されるものではない。

【０１１９】例えば、上述の本発明の原理に基づく平面鏡の配置条件を満足するものであれば、平面鏡の枚数やその配置角度等を任意に設定してもよく、例えば複数枚の平面鏡で反射させる方式（（同図（ｃ）及び（ｄ）参照）を採用してもよい。さらに、平面鏡は、必ずしも平面度の高いものに限定されるものではなく、光ビームの広がり角の条件によっては比較的平面度が低い、即ち略平面状のものであってもよい。光ビームの広がり角を大きくすれば、平面鏡の平面度に起因して光ビームの反射方向が変位したとしても、光ビームの広がり範囲内に配置された受光素子で受光可能となるためである。

【０１２０】さらに、上記第１～第８実施形態では、１つの仮想点を想定した構成としてあるが、本発明は必ずしもこれに限定されるものではなく、「複数の仮想点」を想定した構成であってもよい。「複数の仮想点」を想定するということは、同時に複数の収束点が存在するこ

とを意味し、その各収束点に個別に受光素子を配置することで複数信号の同時伝送を可能とし、その結果、仮想点の数だけ伝送能力が向上する、といった利点がある。

【0121】例えば、複数の仮想点を想定した配置例として、図32（a）及び（b）では1枚の平面鏡を用いた最も基本的な場合（符号P1、P3は仮想点、符号P2、P4は収束点を示す）、図33（a）及び（b）では2枚の平面鏡を用いた場合の概念を示してあるが、その他、本発明の原理を逸脱しない範囲内で上述の各実施形態及びその変形例、応用例に適用できることはいうまでもない。

【0122】

【発明の効果】以上説明したように、本発明の光伝送システムによれば、発光部を回転体の中心軸上に定めた仮想点に向けた角度で光信号を放出可能な位置に配置し、平面鏡を光信号を反射可能な位置に配置し、受光素子を平面鏡の配置位置及び仮想点の互いの幾何光学的な位置関係で定まる光信号の収束点に配置したため、固定体に対して回転体が中心軸を中心に回転している間、発光部から平面鏡に入射される光信号を常に受光素子で受光できると共に、その光信号の光経路長を常に一定の値、即ち発光部を配置した位置と仮想点との間の距離に維持できる。

【0123】従って、遅延差のある信号を受光素子で受ける事態を殆ど回避でき、これにより、信号の復元精度を維持しつつ、回転体と固定体との間を高速に信号伝送することが可能となる。この効果は、特に高速データ伝送を志向したX線CTスキャナ等に最大限に発揮させることができる。

【図面の簡単な説明】

【図1】この発明における光伝送システムの原理を説明する概念図。

【図2】この発明に係る光伝送システムの原理を説明する概念図。

【図3】この発明に係る光伝送システムの原理を説明する概念図。

【図4】この発明に係る光伝送システムの原理を説明する概念図。

【図5】この発明に係る光伝送システムを搭載した回転体及び固定体の構成例を示す概略斜視図。

【図6】第1実施形態における光伝送システムの構成を示す概略正面図。

【図7】図6のA－Aに沿って見た概略側面図。

【図8】レーザ光放出部の位置関係を説明する概略斜視図。

【図9】第2実施形態における光伝送システムの構成を示す概略正面図。

【図10】図9のB－Bに沿って見た概略側面図。

【図11】第3実施形態における光伝送システムの構成を示す概略正面図。

【図12】図11のC－Cに沿って見た概略側面図。

【図13】第4実施形態における光伝送システムの構成を示す概略正面図。

【図14】図13のD－Dに沿って見た概略側面図。

【図15】回転位置検出系の構成例を示す概略正面図。

【図16】信号分配部の構成例を示す概略ブロック図。

【図17】第5実施形態における光伝送システムの構成を示す概略正面図。

【図18】図17のE－Eに沿って見た概略側面図。

【図19】信号受信先における信号切換部の構成例を示す概略ブロック図。

【図20】第5実施形態の応用例における光伝送システムの構成を示す概略正面図。

【図21】図20のF－Fに沿って見た概略側面図。

【図22】第6実施形態における光伝送システムの構成を示す概略正面図。

【図23】図22のG－Gに沿って見た概略側面図。

【図24】信号受信先における信号選択回路の構成例を示す概略ブロック図。

【図25】第6実施形態の応用例で信号加算回路の構成例を示す概略回路図。

【図26】第7実施形態における光伝送システムを搭載した医用X線CTスキャナの構成例を示す概略断面図。

【図27】図26のH－Hに沿って架台内を見た概略正面図。

【図28】図26のI－Iに沿って架台内を見た概略正面図。

【図29】第8実施形態における光伝送システムの構成を示す概略正面図。

【図30】図29のJ－Jに沿って見た概略側面図。

【図31】（a）～（d）は、各実施形態に共通する平面鏡の配置例の概念を示す図。

【図32】（a）及び（b）は、複数の仮想点を配置した場合（平面鏡が1枚）の概念を示す図。

【図33】（a）及び（b）は、複数の仮想点を配置した場合（平面鏡が2枚）の概念を示す図。

【図34】従来技術で発光素子と受光素子の配置を工夫した場合の概念を示す図。

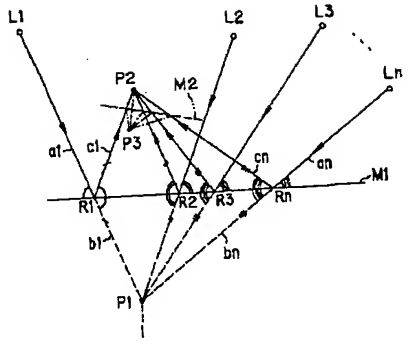
【図35】従来技術で凹面鏡を配置した場合の概念を示す図。

【符号の説明】

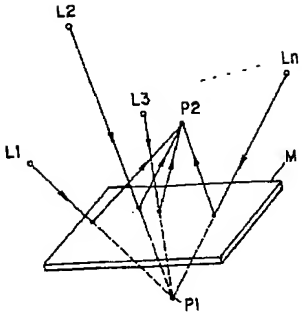
1　回転体
2　固定体
3　送信系
4　受信系
5　信号送信元
6　レーザ光放出部
7　受光部
8　信号受信先
9　平面鏡

１０　受光素子
Ｐ１　仮想点
Ｐ２　収束点

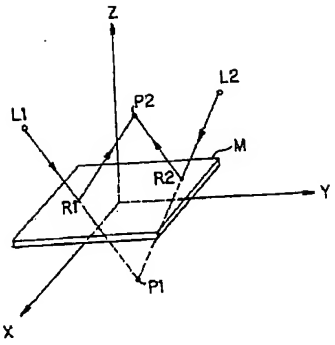
【図１】



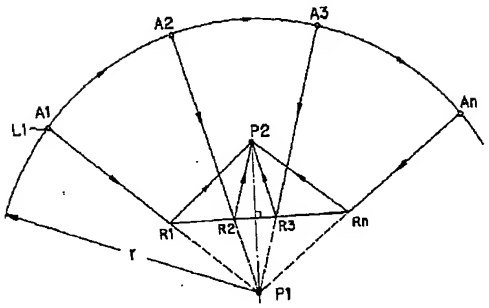
【図２】



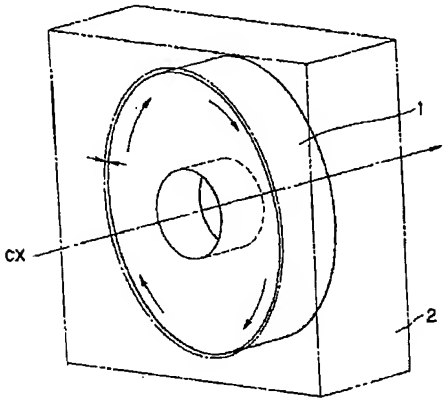
【図３】



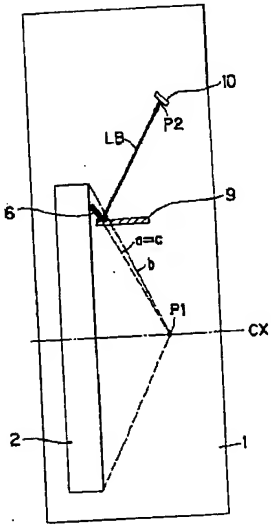
【図４】



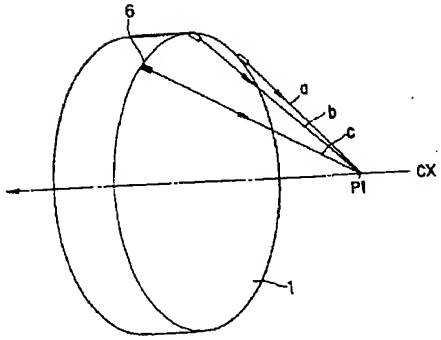
【図５】



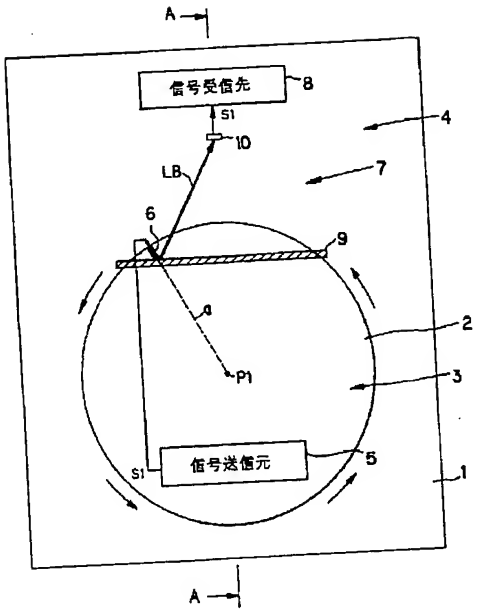
【図７】



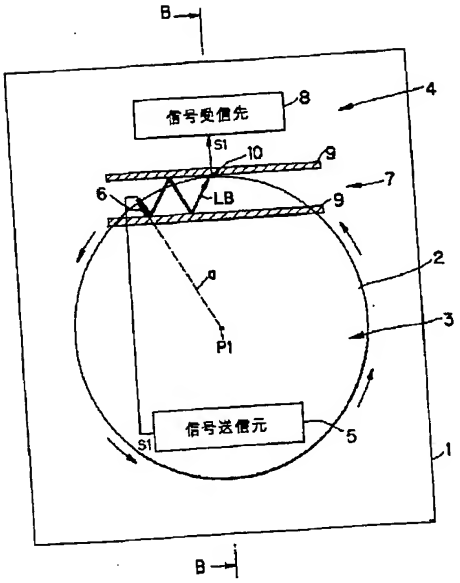
【図８】



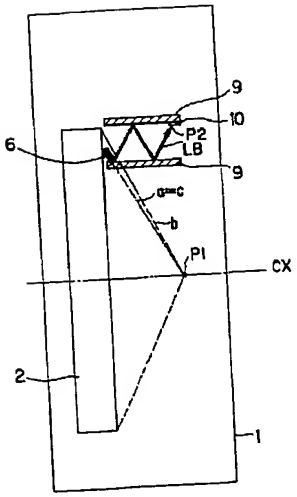
【図6】


A
信号受信先
8
S1
10
4
LB
7
6
9
2
α
P1
3
信号送信元
5
S1
1
A

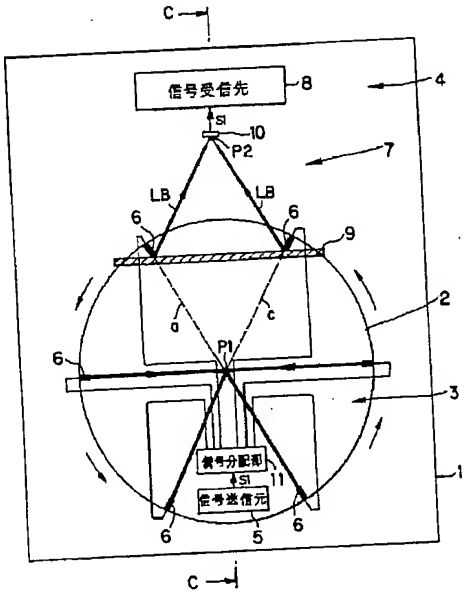
【図9】


B
信号受信先
8
4
S1
10
9
7
6
LB
9
2
α
3
P1
信号送信元
5
S1
1
B

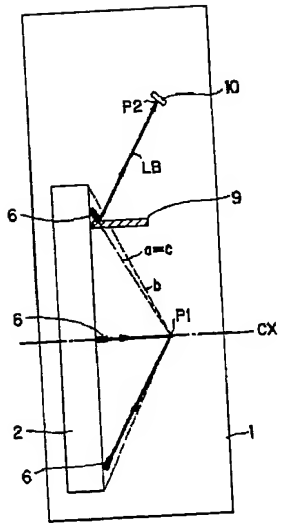
【図10】


9
10
6
P2
LB
9
α=c
b
P1
CX
2
1

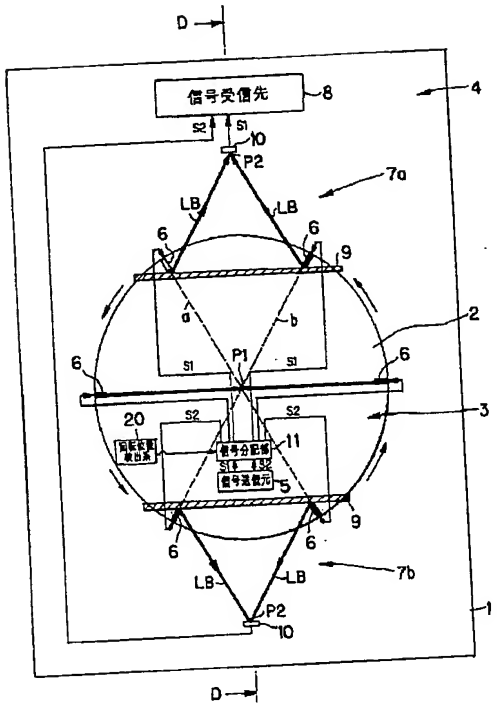
【図11】


C
信号受信先
8
4
S1
10
P2
7
LB
LB
6
6
9
a
c
2
P1
6
3
信号分配部
S1
11
信号送信元
1
6
5
6
C

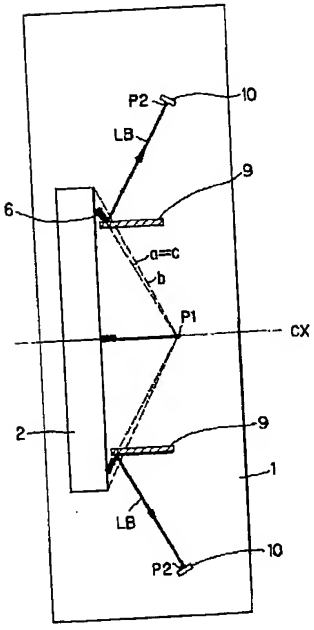
【図12】



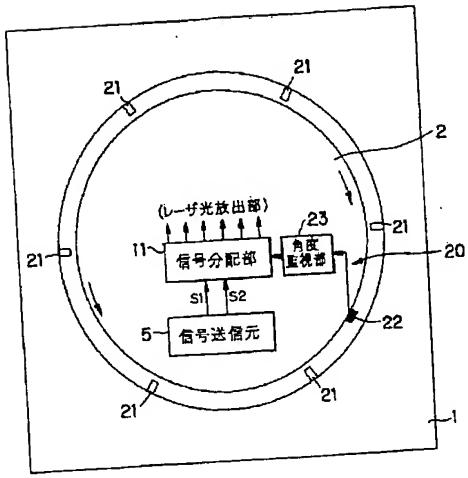
【図13】



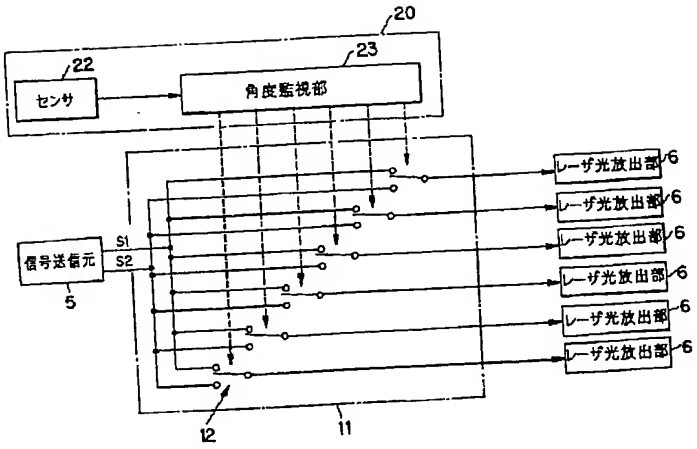
【図14】



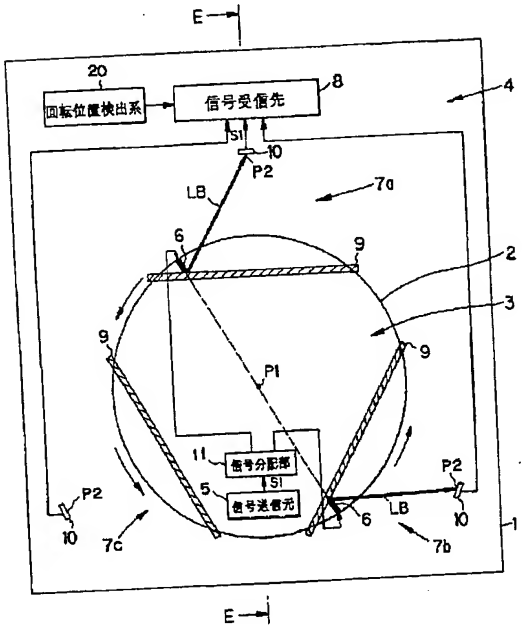
【図16】



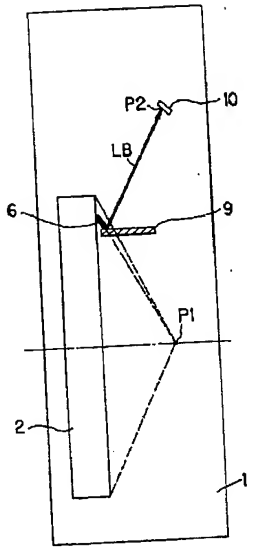
【図15】



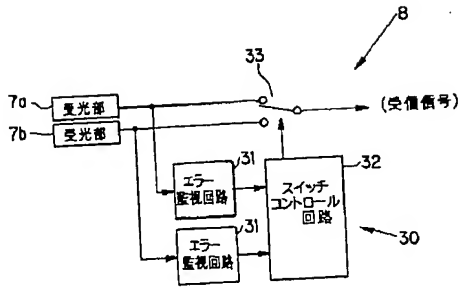
【図17】



【図18】



【図24】



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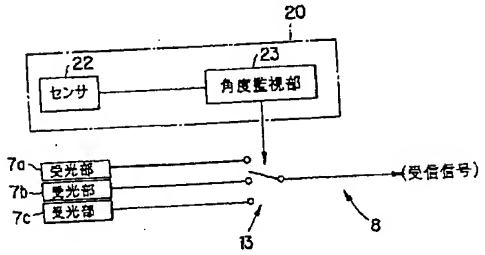
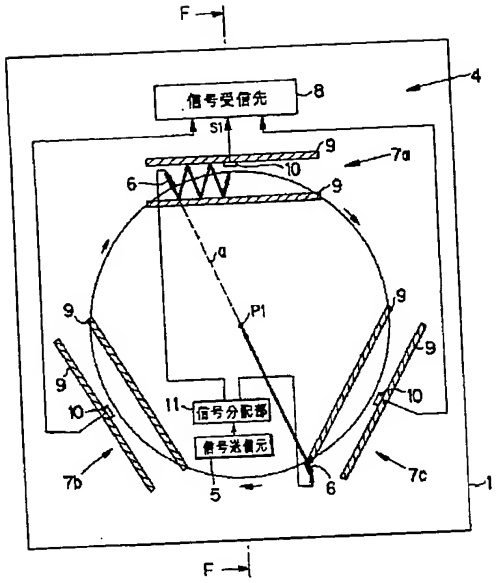
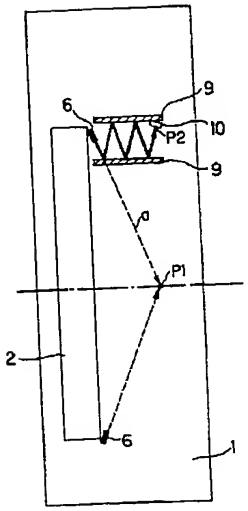


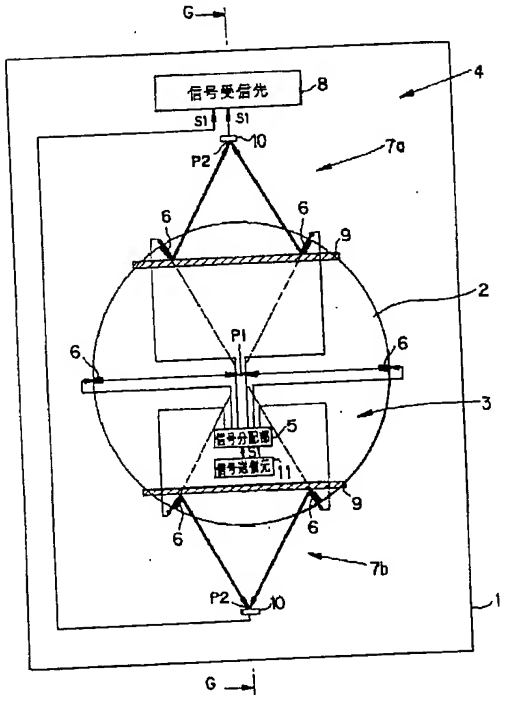
【図20】



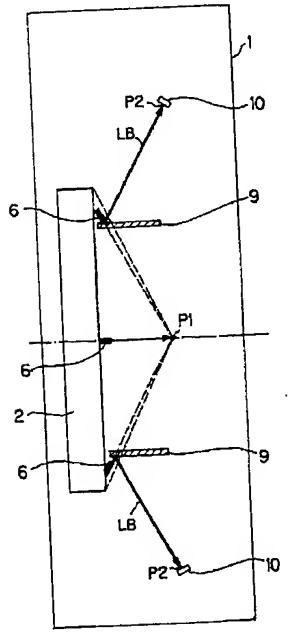
【図21】



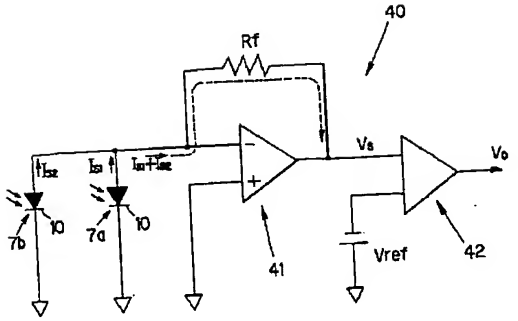
【図22】



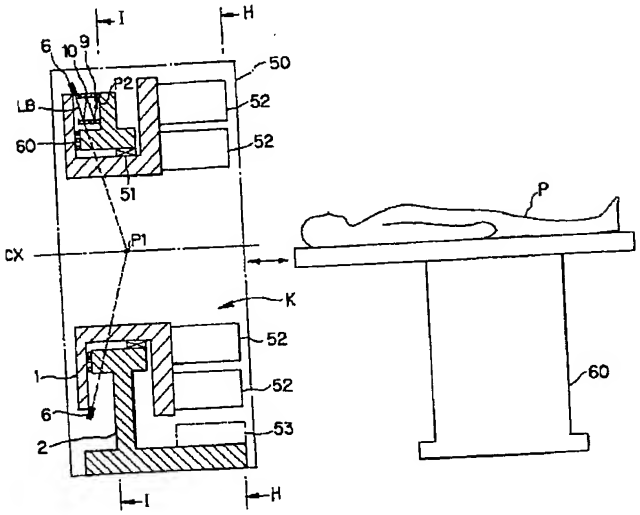
【図23】



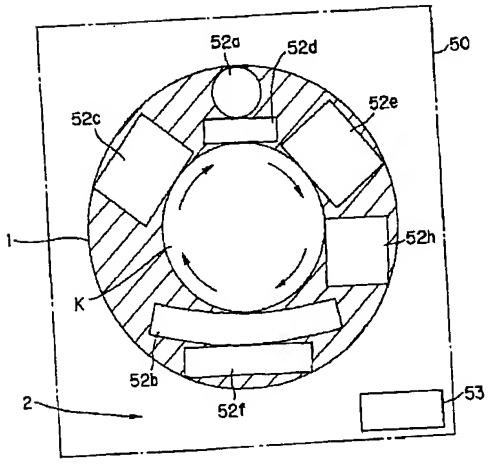
【図25】



【図26】



【図27】



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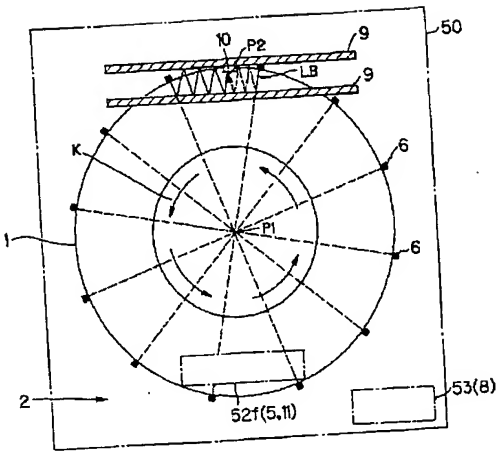
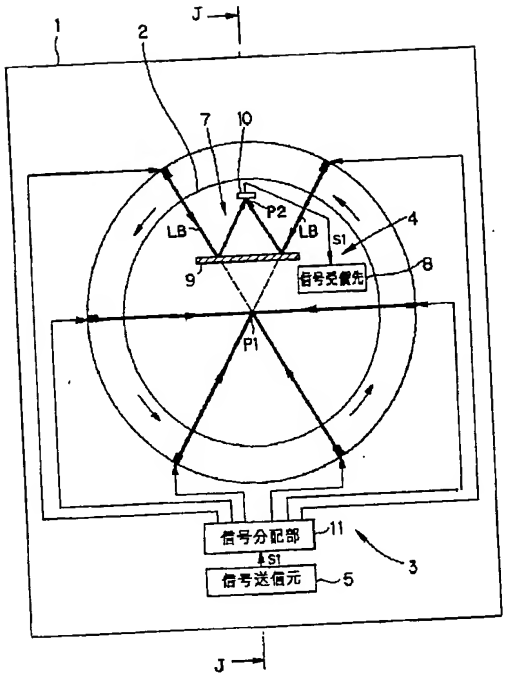


【図29】



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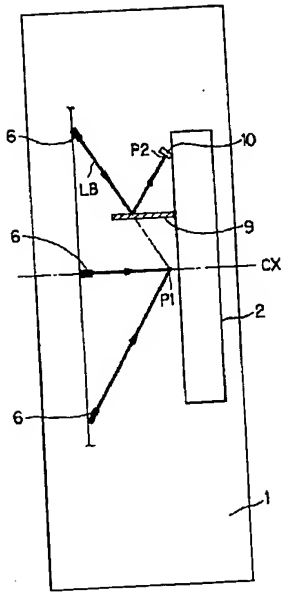
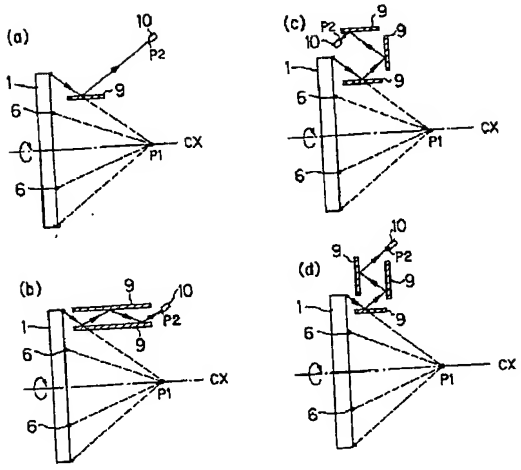


【図31】



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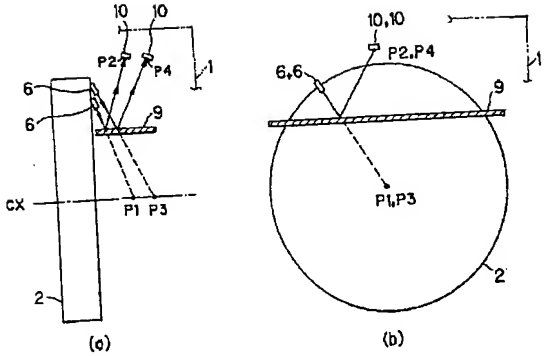
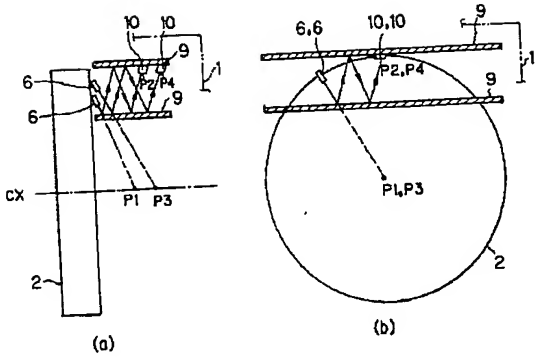
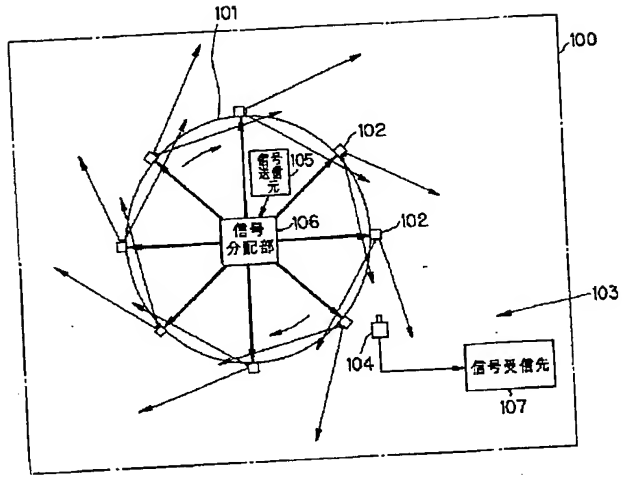


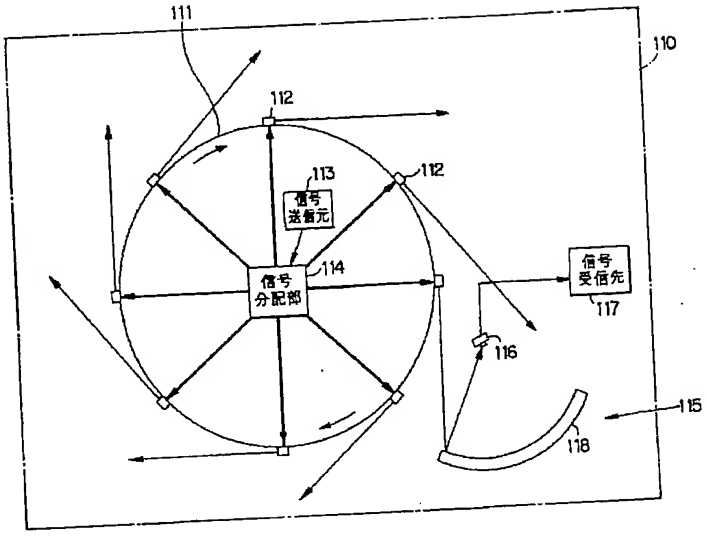
【図33】


10
10
9
1
6
6
P2,P4
9
CX
P1
P3
2
(a)
6,6
10,10
9
1
P2,P4
9
P1,P3
2
(b)

【図34】


101
100
102
信号送信元
105
信号分配部
106
102
103
104
信号受信先
107

【図35】


111
110
112
113
112
信号送信元
信号分配部
114
信号受信先
117
116
115
118

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[JP,09-308625,A]

CLAIMS

[Claim(s)]
[Claim 1] The lightwave transmission system carry out a signal transmission through the transmitting system which sends a lightwave signal for between the body of revolution arranged by non-contact and the fixed objects which are characterized by to have had the following, to have arranged the above-mentioned plane mirror in the position in which the above-mentioned lightwave signal can be reflected, and to have arranged the above-mentioned photo detector to the convergent point of the above-mentioned lightwave signal which becomes settled in the mutual geometrical-optics-physical relationship of the position and the above-mentioned ideal point which has arranged the above-mentioned plane mirror, and the receiving system which receive the above-mentioned lightwave signal. It is the plane mirror the above-mentioned receiving system reflects the above-mentioned lightwave signal while arranging the above-mentioned lightwave signal to the position it can emit at the angle turned to the ideal point prepared to the above-mentioned body of revolution in either [at least] the above-mentioned transmitting system or the above-mentioned receiving systems, had the luminescence section of the above-mentioned transmitting system and the receiving systems in which the above-mentioned transmitting system emits the above-mentioned lightwave signal to the above-mentioned fixed object while having prepared another side at least, and set this luminescence section on the medial axis of the above-mentioned body of revolution. The photo detector which receives the above-mentioned lightwave signal reflected with this plane mirror.
[Claim 2] The aforementioned plane mirror is a lightwave transmission system according to claim 1 which is the plane mirror of two or more sheets.
[Claim 3] The plane mirror of two or more aforementioned sheets is a lightwave transmission system according to claim 2 which is the plane mirror of two sheets, has arranged one side of this plane mirror of two sheets between the positions and the aforementioned ideal points which have arranged the aforementioned luminescence section, countered and has arranged another side of the plane mirrors of the two above-mentioned sheets by above-mentioned one side and non-contact.
[Claim 4] The aforementioned luminescence section is the lightwave transmission system of three the claim 1 which are two or more luminescence sections, or given in any 1 term.

[Claim 5] The aforementioned ideal point is a lightwave transmission system according to claim 4 which are two or more ideal points.
[Claim 6] The lightwave transmission system according to claim 4 which arranged two or more aforementioned luminescence sections at the predetermined intervals along with the circumferencial direction of the aforementioned medial axis.
[Claim 7] The claim 4 to which the aforementioned photo detector arranged the lightwave signal for two or more aforementioned luminescence sections through the aforementioned plane mirror at the same or interval smaller than the range as the range which can receive light, or the lightwave transmission system of six given in any 1 term.
[Claim 8] The aforementioned photo detector is the lightwave transmission system of seven the claim 1 which are two or more photo detectors, or given in any 1 term.
[Claim 9] The aforementioned transmitting system is the lightwave transmission system [equipped with a detection means to detect the positional information about the rotation position of the aforementioned body of revolution to the aforementioned fixed object, and the control means which control the luminescence stage of the aforementioned lightwave signal by the aforementioned luminescence section based on the positional information which this detection means detected] according to claim 8.
[Claim 10] The aforementioned receiving system is the lightwave transmission system according to claim 8 further equipped with a means to add and output two or more electrical signals which two or more aforementioned photo detectors changed.
[Claim 11] The aforementioned receiving system is the lightwave transmission system according to claim 8 further equipped with a means to choose and output two or more electrical signals which two or more aforementioned photo detectors changed.
[Claim 12] The aforementioned receiving system is the lightwave transmission system according to claim 8 further equipped with a detection means to detect the positional information about the rotation position of the aforementioned body of revolution to the aforementioned fixed object, and a means to choose and output two or more electrical signals which two or more aforementioned photo detectors changed based on the positional information which this detection means detected.
[Claim 13] The aforementioned body of revolution and a fixed object change by the in-a-circle member installed in the position of the shaft orientations of opening for a diagnosis in the stand of an X-ray CT scanner side by side, prepare the aforementioned luminescence section in the side of one [at least] above-mentioned shaft orientations of the above-mentioned body of revolution and the fixed objects, and are the claim 1 of the above-mentioned body of revolution and the fixed objects prepared in the side of the above-mentioned shaft orientations of another side at least, or the lightwave transmission system of 12 given in any 1 term about the aforementioned photo detector and a plane mirror.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the lightwave transmission system which started the lightwave transmission system which carries out

the signal transmission of between the body of revolution and the fixed objects which are carried in the stand of a medical X-ray CT scanner etc. through a lightwave signal, especially has arranged optical system.

[0002]

[Description of the Prior Art] Conventionally, the lightwave transmission system which carries out the signal transmission of between the body of revolution and the fixed objects which have been arranged by non-contact through light is known. What devised the physical relationship of a light emitting device and a photo detector etc., and the thing which has arranged optical system between a light emitting device and a photo detector are proposed as what carries out continuation transmission for example, during rotation by this lightwave transmission system. Hereafter, both are explained based on drawing 34 and drawing 35 .

[0003] First, an example of the lightwave transmission system which has arranged the light emitting device and the photo detector is shown in drawing 34 . It is what was applied to the stand of a medical X-ray CT scanner, and the lightwave transmission system shown in this drawing equips with photo detectors (photodiode etc.) 104 the fixed part 103 fixed to the position of the radial outside of this rotation section 101 while equipping this stand 100 with two or more light emitting devices (light emitting diode or laser) 102--102 inside in the outside periphery side of the rotation section 101. The light emitting device 102--102 is arranged at the fixed interval along the periphery side of body of revolution 101, and sends simultaneously the signal of the X-ray picture data distributed through the signal distribution section 106 from signal transmitting former 105 as a lightwave signal along with the tangential direction of the periphery of the rotation section 101.

[0004] Since the array interval of a light emitting device 102 and the degree of angle of divergence of a light beam are adjusted in this lightwave transmission system so that each light beam from at least two adjoining light emitting devices 102 and 102 may be made to overlap mutually While the rotation section 101 is rotating, the light beam spread from at least one light emitting device 102 in two or more light emitting devices 102--102 is can always be received at a photo detector 104, and the electrical signal changed here is restored to the original signal at the signal reception place 107.

[0005] What set the propagation direction of a light beam as the angle towards the shaft orientations of the radial outside of a periphery or body of revolution as this type of a lightwave transmission system is proposed (for example, JP,5-253217,A).

[0006] Next, an example (for example, JP,5-220133,A) of the lightwave transmission system which has arranged the concave mirror is shown in drawing 35 . It is what applied the lightwave transmission system shown in this drawing as well as the above to the stand of a medical X-ray CT scanner, and in the interior of this stand 110, while two or more laser [which oscillates a narrow-beam-like laser beam] (light emitting device) 112--112, and signal transmitting former 113, and the signal distribution section 114 are arranged at the rotation section 111, the concave mirror 118 besides a photo detector 116 and the signal reception place 117 is formed in the fixed part 115.

[0007] While the rotation section 111 is rotating in this lightwave transmission system, Since the curved-surface state of a concave mirror 115 is adjusted so that the laser beam emitted along with the tangential direction of the periphery of the rotation section 111 from at least two adjoining laser 112 and 112 may be led to the photo detector 116 fixed

to one certain point Light-receiving of the laser beam emitted from at least one light emitting device 112 in two or more light emitting devices 112--112 is always attained by the photo detector 114 through a concave mirror 115.

[0008]

[Problem(s) to be Solved by the Invention] however, if it was in the lightwave transmission system of the conventional technology mentioned above, since it was the composition that the distance between a light emitting device and a photo detector changed during rotation of the rotation section, and optical path length (optical path length) changed, two or more lightwave signals from which optical path length differs were received simultaneously -- it originated in the differential delay based on the optical path length difference between two or more of the lightwave signals, and a signal might be unable to restore with a sufficient precision to a case

[0009] This problem was so remarkable that the transmission frequency of a signal became high. Especially the lightwave transmission system with this above-mentioned is because it was not what was conscious of high-speed transmission. Moreover, the above-mentioned problem was so remarkable that the size of the rotation section became large. Light is for an optical path length difference to increase in proportion to the size of the rotation section in order to take the time for 1ns to progress 30cm.

[0010] by the way, on the other hand, in a medical X-ray CT scanner, about the X-ray picture data collected in large quantities at once with progress of the high-speed-scanning technology represented by the helical scan, an image processing and in order to make it display, it is between the body of revolution in a stand, and a fixed object for a short time, and it is important to carry out the signal transmission of the X-ray picture data etc. at high speed in recent years

[0011] However, it was difficult to apply the conventional lightwave transmission system as it is on the restoration precision of the signal transmitted with the medical X-ray CT scanner which aimed at high-speed-data transmission (for example, several 100 Mbps(es)) in this way.

[0012] it can carry out the signal transmission of between body of revolution and fixed objects at high speed, this invention having been made in consideration of the problem of the conventional technology mentioned above, and maintaining the restoration precision of a signal -- it targets to offer a lightwave transmission system Moreover, it sets it as another purpose to offer the optimal lightwave transmission system for the X-ray CT scanner which aimed at high-speed transmission.

[0013]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, a lightwave transmission system according to claim 1 It considers as the composition which carries out a signal transmission through the transmitting system which sends a lightwave signal for between the body of revolution arranged by non-contact, and fixed objects, and the receiving system which receives the above-mentioned lightwave signal. While either [at least] the above-mentioned transmitting system or the above-mentioned receiving systems are prepared in the above-mentioned body of revolution, and inside [it is the above-mentioned transmitting system and a receiving system] establishes another side in the above-mentioned fixed object at least While arranging in the position which can emit the above-mentioned lightwave signal at the angle towards the ideal point which the above-mentioned transmitting system was equipped with the luminescence section

which emits the above-mentioned lightwave signal, and defined this luminescence section on the medial axis of the above-mentioned body of revolution The above-mentioned receiving system is equipped with the plane mirror which reflects the above-mentioned lightwave signal, and the photo detector which receives the above-mentioned lightwave signal reflected with this plane mirror. The above-mentioned plane mirror has been arranged in the position in which the above-mentioned lightwave signal can be reflected, and the above-mentioned photo detector is arranged to the convergent point of the above-mentioned lightwave signal which becomes settled in the mutual geometrical optics-physical relationship of the arrangement position of the above-mentioned plane mirror, and the above-mentioned ideal point.

[0014] In invention according to claim 2, the aforementioned plane mirror is a plane mirror of two or more sheets.

[0015] In invention according to claim 3, the plane mirror of two or more aforementioned sheets is a plane mirror of two sheets, has arranged one side of this plane mirror of two sheets between the positions and the aforementioned ideal points which have arranged the aforementioned luminescence section, and counters and arranges another side of the plane mirrors of the two above-mentioned sheets according to above-mentioned one side and non-contact.

[0016] In invention according to claim 4, the aforementioned luminescence sections are two or more luminescence sections.

[0017] In invention according to claim 5, the aforementioned ideal points are two or more ideal points.

[0018] In invention according to claim 6, two or more aforementioned luminescence sections are arranged at the predetermined intervals along with the circumferencial direction of the aforementioned medial axis.

[0019] In invention according to claim 7, the aforementioned photo detector has arranged the lightwave signal for two or more aforementioned luminescence sections through the aforementioned plane mirror at the same or interval smaller than the range as the range which can receive light.

[0020] In invention according to claim 8, the aforementioned photo detectors are two or more photo detectors.

[0021] The aforementioned transmitting system is equipped with a detection means to detect the positional information about the rotation position of the aforementioned body of revolution to the aforementioned fixed object, and the control means which control the luminescence stage of the aforementioned lightwave signal by the aforementioned luminescence section based on the positional information which this detection means detected in invention according to claim 9.

[0022] In invention according to claim 10, the aforementioned receiving system is further equipped with a means to add and output two or more electrical signals which two or more aforementioned photo detectors changed.

[0023] In invention according to claim 11, the aforementioned receiving system is further equipped with a means to choose and output two or more electrical signals which two or more aforementioned photo detectors changed.

[0024] In invention according to claim 12, the aforementioned receiving system is further equipped with a detection means to detect the positional information about the rotation position of the aforementioned body of revolution to the aforementioned fixed object, and

a means to choose and output two or more electrical signals which two or more aforementioned photo detectors changed based on the positional information which this detection means detected.

[0025] In invention according to claim 13, the aforementioned body of revolution and the fixed object changed by the in-a-circle member installed in the position of the shaft orientations of opening for a diagnosis in the stand of an X-ray CT scanner side by side, the aforementioned luminescence section was prepared in the side of one [at least] above-mentioned shaft orientations of the above-mentioned body of revolution and the fixed objects, and inside [it is the above-mentioned body of revolution and a fixed object] has prepared the aforementioned photo detector and the plane mirror in the side of the above-mentioned shaft orientations of another side at least.

[0026]

[Embodiments of the Invention] The principle of the lightwave transmission system concerning this invention common to each following operation gestalt is explained to the beginning based on drawing 1 - drawing 4 .

[0027] Drawing 1 explains the light reflex path when making one laser beam (it being hereafter called a "ideal point") emit towards P1, and reflecting each laser beam with a plane mirror M1 temporarily defined from the position where each laser Lx has been arranged, and optical path length supposing n laser Lx (x= 1, 3 [2 and 3], --, n (it is below the same)) arranged in the same field.

[0028] As shown in this drawing, each laser beam which carried out incidence to the plane mirror M1 is reflected at the angle which always becomes symmetrical with an ideal point P1 and a field on both sides of a plane mirror M1 by geometrical optics rectilinear propagation and reflexive law of a beam of light even if it is in which incidence position Rx and which goes to P2 one point (it is hereafter called a "convergent point"). therefore, each optical path length from each laser Lx to a convergent point P2 -- dx -- carrying out -- a segment -- the time of setting each length of LxRx to ax, setting each length of a segment RxP2 to bx, and setting each length of a segment RxP1 to cx -- bx=cx and a bird clapper to the optical path length dx -- [Equation 1] dx=ax+cx=ax+bx .... (1)

It is expressed by the ** type. That is, the optical path length dx is equal to the optical path length to the ideal point P1 when presupposing that there is no plane mirror M1.

[0029] Therefore, in this invention, it noted that the convergent point based on the mutual geometrical optics-physical relationship of an ideal point and a plane mirror surely exists, and being equal to the optical path length to an ideal point when the optical path length to the convergent point presupposes that there is no plane mirror.

[0030] Although the above-mentioned physical relationship is an example which has arranged the plane mirror of one sheet, when the plane mirror of two or more sheets has been arranged, it is materialized similarly. For example, if a plane mirror M1 and another plane mirror M2 between convergent points P2 are arranged as shown in drawing 1 , each laser beam which carried out incidence to the plane mirror M2 will be reflected on both sides of a plane mirror M2 at the angle which goes to a convergent point P2 and the new convergent point P3 which becomes symmetrical with a field (refer to the two-dot chain line in drawing 1). Therefore, each optical path length to a convergent point P3 is equal to each optical path length to the ideal point P1 when presupposing that there is none of each optical path length dx M1 to the convergent point P2 when presupposing that there

is no plane mirror M2, i.e., a plane mirror.
[0031] Although the above-mentioned physical relationship is the example of the laser arranged in the same side, as shown in drawing 2 , it is similarly materialized about two or more laser Lx arranged in space. This physical relationship is examined based on drawing 3 .
[0032] First, two laser L1 and L2 is arranged in the XYZ space shown in drawing 3 , and it considers as the angle which turned the sense of each of that laser L1 and L2 at the point (ideal point) P1, and suppose that the plane mirror M has been arranged on XY flat surface between the each laser L1 and L2 and ideal point P1.
[0033] Here, it is [Equation 2] about each unit vectors A1 and B1 of the direction of the light which carries out incidence to a plane mirror M. A1= (a1, a2, a3) .... (2)
[Equation 3] B1= (b1, b2, b3) .... the coordinate of (3) -- expressing -- the intersection P1 of the extension wire of each of these unit vectors A1 and B1, i.e., a point, -- [Equation 4] P1= (p1, p2, p3) .... (4)
Each unit vector A2 of the direction of light reflected with the plane mirror M when expressed with ******, and B-2 are [Equation 5]. A2= (a1, a2, -a3) .... (5)
[Equation 6] B-2= (b1, b2, -b3) .... (6)
It becomes ******. Therefore, while the extension wire of each unit vector A2 and B-2 crosses at a point P2 (convergent point) from above-mentioned (2) - (6), this point P2 is [Equation 7]. P2= (p1, p2, -p3) .... (7)
From ****** and a bird clapper, an above-mentioned convergent point and the point about optical path length paying their attention are materialized about the plane mirror arranged at the laser arranged in space, and arbitrary angles. That is, if the sense of laser is an angle towards the ideal point, it is good at arbitrary angles, and if the sense of the plane mirror to the laser is also in the state in which incidence is possible about light, it is good at arbitrary angles. Moreover, it is the same when carrying out multiple-times reflection of the light using the plane mirror of two or more sheets.
[0034] The above point paying its attention is similarly materialized, as long as the angle towards the ideal point is being maintained, even if it moves the position of laser. If laser is moved where the distance between laser and an ideal point is maintained especially uniformly, the position of a convergent point not only does not change, but the optical path length to the convergent point will become fixed. For example, if the conditions to which laser L1 is moved along with the circumferencial direction centering on an ideal point P1 are considered as shown in drawing 4 , while reflecting the laser beam by which incidence was carried out to the plane mirror M from each move position Ax at the angle which always goes to a convergent point P2, each optical path length to a convergent point P2 always maintains the optical path length r to an ideal point P1, i.e., a radius.
[0035] Hereafter, the operation gestalt of this invention is explained one by one.
[0036] (The 1st operation gestalt) The 1st operation gestalt of this invention is first explained based on drawing 5 - drawing 8 . The lightwave transmission system concerning this 1st operation gestalt is [most fundamental] applicable to a medical X-ray CT scanner based on the principle of above-mentioned invention.
[0037] Drawing 5 explains the arrangement situation of the body of revolution 1 in which the lightwave transmission system was carried, and the fixed object 2. the frame in housing with which body of revolution 1 changes from the in-a-circle member which has opening (it omits for convenience in each following drawing) to the medial axis CX, and

the fixed object 2 supports body of revolution 1 free [rotation] as shown in this drawing -- it consists of a member etc.

[0038] The lightwave transmission system shown in drawing 6 and drawing 7 is the composition which has arranged the transmitting system 3 which sends a lightwave signal to body of revolution 1, and has arranged the receiving system 4 which receives a lightwave signal in the fixed object 2, and performs the signal transmission through the light from the body of revolution 1 to the fixed object 2.

[0039] The transmitting system 3 is equipped with signal transmitting former 5 which supplies the signal S1 for transmission, and the laser beam discharge section (the luminescence section of this invention is accomplished) 6 which changes the signal S1 from this signal transmitting former 5 into a lightwave signal, and is emitted as a beam-like laser beam LB.

[0040] The laser beam discharge section 6 consists of laser, such as a laser diode, and is fixed to the side of the shaft orientations of body of revolution 1. In this laser beam discharge section 6, the discharge angle (the direction of the center line of a beam) of a laser beam LB is set as the angle which goes to the ideal point P1 defined on the medial axis CX. (Refer to the signs a and b in drawing 8 , and c) . That is, the physical relationship of the laser beam discharge section 6 and an ideal point P1 becomes equivalent to the physical relationship of the base periphery section of a right circular cone, and the peak. Therefore, this laser beam discharge section 6 always emits the beam-like laser beam LB at the fixed angle which goes to an ideal point P1, while body of revolution 1 is rotating.

[0041] The receiving system 4 is equipped with the light-receiving section 7 which changes a laser beam LB into an electrical signal, and receives it from the laser beam discharge section 6, and the signal reception place 8 which changes into the original signal S1 the electrical signal changed in this light-receiving section 7 (restoration).

[0042] The light-receiving section 7 is equipped with the plane mirror 9 which reflects the laser beam from the laser beam discharge section 6, and the photo detector 10 which receives the laser beam reflected with this plane mirror 9.

[0043] A plane mirror 9 is arranged between the laser beam discharge section 6 and an ideal point P1, and is fixed to the fixed object 1 at the angle with the reflector parallel to the shaft orientations of body of revolution 1. This plane mirror 9 carries out incidence of the laser beam LB, when the laser beam discharge section 6 is in a predetermined rotation position (it is hereafter called a "light-receiving position" for convenience), and it reflects this in a photo-detector 10 side.

[0044] It consists of a photodiode and a photo detector 10 is arranged in the above-mentioned convergent point P2 which becomes settled in the mutual physical relationship of the position and ideal point P1 by which the plane mirror 9 has been arranged. The feeble current signal changed by the photo detector 10 is outputted to the signal reception place 8.

[0045] Next, an operation of this whole operation gestalt is explained.

[0046] First, body of revolution 2 presupposes that it rotated focusing on the medial axis CX, and the laser discharge section 6 rotated to the light-receiving section 7 in connection with this to the fixed object 2. It is emitted at the angle which the signal from signal transmitting former 8 is changed into a lightwave signal in the laser beam discharge section 6, and goes to an ideal point P1 as a laser beam LB in this state.

[0047] Here, when the laser discharge section 6 is in a light-receiving position, light-receiving of a laser beam LB is attained at the photo detector 10 arranged through a plane mirror 9 at the convergent point P2. At this time, the optical path length of a laser beam LB is equal to the distance to the ideal point P1 when presupposing that there is no plane mirror 9, and always fixed regardless of the position of the laser beam discharge section 6.

[0048] Therefore, while the laser beam LB by which incidence is carried out to a plane mirror 9 while the laser discharge section 6 is rotating is always led to a photo detector 10, the situation of receiving the signal with which a photo detector 9 has a differential delay since it is always fixed regardless of the position of the laser beam discharge section 6 also for the optical path length almost comes to be avoided. Thereby, maintaining the restoration precision of a signal, the transmission frequency of a signal can be raised and it becomes possible to attain high-speed transmission-ization.

[0049] Moreover, secondarily, since the plane mirror was adopted as optical system, compared with a comparatively expensive concave mirror with the complicated and former, there is also an advantage that it can manufacture easily and comparatively cheaply.

[0050] In addition, although the beam-like laser beam is used with this operation gestalt, the light beam which is not limited to this and has fixed angles of divergence, such as the shape of a cone, is sufficient as this invention. Therefore, the composition using light emitting devices, such as light emitting diode which is not limited to the composition which used laser and emits a light beam, is sufficient as the luminescence section.

[0051] Moreover, a detection means to detect the positional information of body of revolution to a fixed object as an application of this operation gestalt (let a sensor be an important section), So that a lightwave signal may be sent based on the positional information which this detection means detected, when the rotation position of the laser beam discharge section is located in a lightwave signal in the light-receiving position which can be transmitted to the light-receiving section You may add the control means which control the drive timing of the signal supply and a halt to the laser beam discharge section from signal transmitting origin to body of revolution.

[0052] Moreover, as another application, the halt position of body of revolution is beforehand set as a light-receiving position, and when this body of revolution stops, you may add the composition which performs a signal transmission.

[0053] (The 2nd operation gestalt) Next, the 2nd operation gestalt of this invention is explained based on drawing 9 and drawing 10 . This 2nd operation gestalt arranges the plane mirror of two sheets in the above-mentioned light-receiving section. a sign the same about a component the same as that of the above-mentioned 1st operation gestalt or equivalent here or equivalent is attached, and simple in the explanation -- or it omits

[0054] The lightwave transmission system shown in drawing 9 and drawing 10 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from the body of revolution 1 to the fixed object 2 through the transmitting system 3 and the receiving system 4. The transmitting system 3 is equipped with the one laser beam discharge section 6, and the receiving system 4 is equipped with the one light-receiving section 7.

[0055] The light-receiving section 7 is equipped with the plane mirrors 9 and 9 of two

sheets, and one photo detector 10, counters and installs the plane mirrors 9 and 9 of two sheets in the position where radial [of the medial axis CX of body of revolution 1] differs side by side, arranges a photo detector 10 to the convergent point P2 which becomes settled in the physical relationship of the position of the plane mirrors 9 and 9 of two sheets, and an ideal point P1, and is formed in it.

[0056] Here, when the laser beam discharge section 6 is in a light-receiving position, the laser beam LB reflected with the plane mirrors 9 and 9 of two sheets is always led to a photo detector 10, and the optical path length is also always equal to the distance between the fixed value 6, i.e., the laser beam discharge section, and an ideal point P1.

[0057] therefore, with this operation gestalt, there is an advantage which can build compactly the stand of a making [in addition to an effect equivalent to the above-mentioned 1st operation gestalt / the space in a stand which arrangement of the light-receiving section takes, especially the radial space of a stand / small in each stage] shell, and a medical X-ray CT scanner

[0058] (The 3rd operation gestalt) Next, the 3rd operation gestalt of this invention is explained based on drawing 11 and drawing 12 . The lightwave transmission system concerning this 3rd operation gestalt arranges two or more laser beam discharge sections and the one light-receiving section, and aims at continuation transmission. a sign the same about a component the same as that of the above-mentioned 1st operation gestalt or equivalent here or equivalent is attached, and simple in the explanation -- or it omits

[0059] The lightwave transmission system shown in drawing 11 and drawing 12 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from body of revolution 1 to a fixed object through the transmitting system 3 and the receiving system 4. The receiving system 4 equips the one light-receiving section 7 equivalent to the above-mentioned 1st operation gestalt with a plane mirror 9 and a photo detector 10.

[0060] The transmitting system 3 is equipped with the signal distribution section, signal transmitting former 5 which supplies a signal S1, and the plurality 6--6 arranged at the fixed interval in the outside periphery section of body of revolution 1, for example, the six laser beam discharge sections, 11 which distributes the signal S1 from signal transmitting former 5 to two or more laser discharge sections 6--6.

[0061] The signal distribution section 11 consists of a predetermined signal distribution circuit, distributes the signal S1 serially supplied from signal transmitting former 5 according to the number of the laser discharge section 6--6 as it is, and supplies this to each laser discharge section 6--6 individually.

[0062] The laser beam discharge section 6--6 arranges the laser of plurality (for example, six pieces) at a fixed interval to the circumferencial direction of body of revolution 1, and changes, and all the discharge directions of laser beam LB--LB are set as the angle which goes to an ideal point P1. In order to perform continuation transmission on the fixed object 2 from body of revolution 1, as for the array interval of this laser beam discharge section 6--6, it is desirable for the light-receiving section 7 to set up smaller [it is equal to the range which can receive a laser beam, or] than the range.

[0063] For this reason, while body of revolution 1 is rotating to the fixed object 2, light-receiving of at least one of two or more laser beam LB--LB from two or more laser beam discharge sections 6--6 is attained by the photo detector 9 through a plane mirror 10.

[0064] Therefore, in addition to an effect equivalent to the above-mentioned 1st operation gestalt, with this operation gestalt, there is an advantage which can perform continuation transmission of the signal from body of revolution to a fixed object.
[0065] In addition, although considered as the composition which has arranged laser individually in two or more laser beam discharge sections 6--6 with this operation gestalt, this invention is not necessarily limited to this.
[0066] For example, arrange one laser in the signal distribution section 11, and two or more optical fibers which responded to the number of the laser beam discharge sections 6--6 at the signal distribution section 11 are connected. You may be the composition to which supply the transmission signal through light to each laser beam discharge section 6--6 individually through each optical fiber from the signal distribution section 11, and a laser beam is made to emit indirectly through optical system, such as a lens, directly from the point of the optical fiber. In this case, in order to make all the laser beam discharge sections 6--6 emit light simultaneously depending on the transmission frequency of a signal, it is desirable to make equal all the path length of each optical fiber from the signal distribution section 11 to the laser beam discharge section 6--6.
[0067] (The 4th operation gestalt) Next, the 4th operation gestalt of this invention is explained based on drawing 13 - drawing 16 . The lightwave transmission system concerning this 4th operation gestalt arranges two or more laser beam discharge sections and two or more light-receiving sections. a sign the same about a component the same as that of each above-mentioned operation gestalt or equivalent here or equivalent is attached, and simple in the explanation -- or it omits
[0068] The lightwave transmission system shown in drawing 13 and drawing 14 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from the body of revolution 1 to the fixed object 2 through the transmitting system 3 and the receiving system 4. Moreover, body of revolution 1 is equipped with the rotation position detection system 20 which detects the rotation position of the body of revolution 1 to the fixed object 2 to this lightwave transmission system.
[0069] The receiving system 4 equips with the two light-receiving sections 7a and 7b the position (angular position of 180 degrees centering on a medial axis) which counters on both sides of the medial axis CX of body of revolution 1, and equips each of the two light-receiving sections 7a and 7b with a plane mirror 9 and a photo detector 10.
[0070] The transmitting system 3 is equipped with signal transmitting former 5 which supplies two transmission signals S1 and S2 in the independent path, the laser beam discharge section [two or more (for example, six pieces)] 6--6 equivalent to the above-mentioned 3rd operation form, and the signal distribution section 11 which distributes the transmission signals S1 and S2 from signal transmitting former 5 to each laser discharge section 6--6.
[0071] As shown in drawing 15 , from signal transmitting former 5, the signal distribution section 11 distributes individually either of the two signals S1 and S2 supplied to parallel to each laser beam discharge section 6--6, supplies it to it, and is equipped with the signal change section 12 for switching two signals S1 and S2.
[0072] It consists of change-over switches, such as a multiplexer, and the signal change section 12 performs switching about the supply start of two signals S1 and S2 given every laser beam discharge section 6--6, a halt, and a change based on the control signal

from the rotation position detection system 20.
[0073] The rotation position detection system 20 is equipped with two or more plates 21--21 arranged at the fixed interval at the circumferencial direction at the inner skin of the fixed object 2 which counters the outside periphery section of body of revolution 1, the sensors 22, such as a photosensor for positional information detection arranged at the outside periphery section of body of revolution 1 so that this plate 21--21 may be crossed, and the angle Monitoring Department 23 which supervises the positional information of this sensor 22 as shown in drawing 16 .
[0074] A sensor 22 is crossing two or more plates 21--21 arranged at the fixed object 2 while body of revolution's 1 rotates, detects the positional information of body of revolution 1 to the fixed object 2 with the resolution proportional to this number of plates, and outputs this to the angle Monitoring Department 23.
[0075] The angle Monitoring Department 23 so that only the signal S1 which is always one side in one light-receiving section 7a may be received based on the detecting signal from a sensor 22 while each laser beam discharge section 6--6 rotates, and only the signal S2 of another side may be received in light-receiving section 7b of another side The supply start of the signals S1 and S2 given to each laser beam discharge section 6--6, its halt, and the control signal about switch time are supplied to the signal distribution section 12.
[0076] For this reason, while body of revolution 1 is rotating to the fixed object 2, while is supplied from signal transmitting former 5, and while a signal S1 is received by light-receiving section 7a which is always one side, the signal S2 of another side is also always received by light-receiving section 7b of another side.
[0077] therefore, with this operation form, since the predetermined signal of two or more signals of signal transmitting origin is always received in the predetermined light-receiving section according to the rotation position of the body of revolution to a fixed object in addition to an effect equivalent to the above-mentioned 1st operation form, there is an advantage which can carry out the parallel transmission of two or more signals to **** continuously
[0078] In addition, although the plate and the sensor are adopted as the rotation position detection system with this operation gestalt, in this invention, it may not necessarily be limited to this, and the composition using the encoder etc. may be used.
[0079] Moreover, with this operation gestalt, although the rotation position detection system is prepared in body of revolution, this invention is not necessarily limited to this and may prepare a rotation position detection system in a fixed object. In this case, what is necessary is to arrange a sensor on a fixed object, to arrange a plate to body of revolution, and just to detect angle of rotation by the fixed object side. Moreover, you may measure angle of rotation of body of revolution by attaching an encoder to the drive motor carried in the rolling mechanism of a fixed object, and detecting the rotation position of the drive motor with an encoder.
[0080] (The 5th operation gestalt) Next, the 5th operation gestalt of this invention is explained based on drawing 17 - drawing 19 . The lightwave transmission system concerning this 5th operation gestalt arranges two or more laser beam discharge sections and two or more light-receiving sections. a same or equivalent sign is attached and simple [in the explanation] about a component the same as that of the 1st operation gestalt, or equivalent here, -- or it omits

[0081] The lightwave transmission system shown in drawing 17 and drawing 18 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from the body of revolution 1 to the fixed object 2 through the transmitting system 3 and the receiving system 4. Moreover, the fixed object 2 is equipped with the rotation position detection system 20 at this lightwave transmission system.
[0082] The rotation position detection system 20 arranges a plate (not shown) equivalent to the above-mentioned 4th operation gestalt to body of revolution, stations the sensor 22 equivalent to the above-mentioned 4th operation gestalt, and the angle Monitoring Department 23 on a fixed object, changes, and supplies the control signal by the angle Monitoring Department 23 to the receiving system 4.
[0083] The receiving system 4 is equipped with the three light-receiving sections 7a, 7b, and 7c arranged at the fixed interval (for example, 120 degrees centering on a medial axis CX) at the outside periphery section of body of revolution 1, and the signal reception place 8 which receives the feeble current signal changed by each of this light-receiving section 7a--7c.
[0084] The signal reception place 8 is based on a control signal from the angle Monitoring Department 23, as shown in drawing 19 , and it is three light-receiving section 7a. -- The light-receiving section as which it was instructed of the 7c is chosen, and it has the signal change section 13 which consists of change-over switches, such as a multiplexer which switches the signal from the light-receiving section to an input signal.
[0085] The transmitting system 3 equips the position which sandwiches signal transmitting former 5 which supplies a signal S1, and the medial axis CX of body of revolution 1 with the two laser beam discharge sections 6 and 6 by which opposite arrangement was carried out, and the signal distribution section 11 which distributes simultaneously the signal S1 from signal transmitting former 5 to the two laser discharge sections 6 and 6. The array interval of the laser beam discharge sections 6 and 6 is set up more greatly than the range in which the one light-receiving section can receive a laser beam LB.
[0086] For this reason, at least one side of the laser beams LB and LB from the two laser beam discharge while body of revolution 1 is rotating sections 6 and 6 is three light-receiving section 7a. -- Light-receiving becomes possible at at least one of 7c, and only the feeble current signal changed in the light-receiving section in which the light-receiving is possible is always chosen as an input signal, and is restored to the original signal S1.
[0087] Therefore, in addition to an effect equivalent to the above-mentioned 4th operation gestalt, with this operation gestalt, there is an advantage which can cut down the number of the laser beam discharge sections required for continuation transmission.
[0088] In addition, they are three light-receiving section 7a as an application of this 5th operation gestalt. -- The case where the plane mirrors 9 and 9 of two sheets have been individually arranged to 7c is shown in drawing 20 and drawing 21 . In this case, the space which the light-receiving section takes can be made small, and there is an advantage which can build equipment itself compactly.
[0089] (The 6th operation gestalt) Next, the 6th operation gestalt of this invention is explained based on drawing 22 - drawing 24 . The lightwave transmission system concerning this 6th operation gestalt arranges two or more laser beam discharge sections

and two or more light-receiving sections. a sign the same about a component the same as that of each above-mentioned operation gestalt or equivalent here or equivalent is attached, and simple in the explanation -- or it omits

[0090] The lightwave transmission system shown in drawing 22 and drawing 23 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from the body of revolution 1 to the fixed object 2 through the transmitting system 3 and the receiving system 4. The transmitting system 3 is composition equivalent to the above-mentioned 3rd operation gestalt.

[0091] The receiving system 4 is equipped with the two light-receiving sections 7a and 7b equivalent to the above-mentioned 4th operation gestalt, and the signal reception place 8 which receives the feeble current signal changed in both the light-receiving sections 7a and 7b, and the signal reception place 8 is equipped with the signal selection circuitry 30 to which either of the signals individually inputted from the two light-receiving sections 7a and 7b is made to choose and output.

[0092] The error supervisory circuits 31 and 31 individually connected to each output side of the two light-receiving sections 7a and 7b as the signal selection circuitry 30 is shown in drawing 24 , The switch control circuit 32 which operates in response to the control signal from these error supervisory circuits 31 and 31, Based on the control signal from this switch control circuit 32, with the composition equipped with the signal change section 33 which consists of change-over switches, such as a multiplexer which switches an input signal When a transmission error occurs, the signal of the side which the transmission error has not generated is chosen and this is made to output as an input signal.

[0093] It judges whether the error supervisory circuit 31 has reception for example, within a predetermined period, and consists of the transmission error detection circuit which adopted sign collating methods, such as a circuit which detects the generating existence of a transmission error according to the judgment result, or CRC (CyclicRedundancy Check), and the control signal about the generating existence of a transmission error is supplied to the switch control circuit 32.

[0094] Therefore, with this operation gestalt, since the signal-transmission path was duplex-ized in addition to the effect equivalent to each above-mentioned operation gestalt, the laser beam discharge section, failure of a photo detector, and a gap of alignment can be coped with, and, thereby, the transmission data security of a system comes to improve sharply.

[0095] In addition, as an application of this operation gestalt, a signal adder circuit may be established in a signal transmission place, and the circuitry which makes an input signal the signal added in the signal adder circuit may be adopted. An example of this signal adder circuit is shown in drawing 25 .

[0096] The signal adder circuit 40 shown in drawing 25 equips the output side of two photodiodes (photo detector) 10 and 10 with the current-voltage conversion amplifier 41 and a comparator 42.

[0097] It consists of an operational amplifier and the I-V converter which carried the feedback resistance Rf, and the current-voltage conversion amplifier 41 transforms into a voltage signal Vs (Vs=Rf (Is1+Is2)) the current signal (Is1+Is2) adding the feeble current signals Is1 and Is2 changed by each photodiodes 10 and 10, and outputs it to a

comparator 42.
[0098] A comparator 42 consists of the comparator circuit which carried the operational amplifier, compares mutually the output voltage Vs and reference voltage Vref from current-voltage conversion amplifier, and outputs the voltage signal V of the digital variable according to the size of the comparison result as an input signal.
[0099] In addition, although considered as the composition which adds and outputs each signal from two or more light-receiving sections in this application, when the number of the light-receiving sections is one, for example, a photodiode can be set to one and a digital signal can be taken out similarly. In this case, you may carry a signal adder circuit in the light-receiving section at one. Moreover, a signal adder circuit may be composition added in a logical-addition circuit, after changing the electrical signal from a photodiode into a digital signal.
[0100] (The 7th operation gestalt) Next, the 7th operation gestalt of this invention is explained based on drawing 26 - drawing 28 . This 7th operation gestalt carries and carries out the lightwave transmission system which performs the signal transmission from body of revolution to a fixed object to the stand of a medical CT scanner. a same or equivalent sign is attached and simple [in the explanation] about a component the same as that of the above 1st - 6 real gestalten, or equivalent here, -- or it omits
[0101] In the medical X-ray CT scanner carrying the stand 50 and berth 60 which are shown in drawing 26 , the berth 60 which carried Subject P moves to the shaft orientations of the opening K for a diagnosis of a stand 50, and X-ray CT photography of Subject P is performed by this opening K for a diagnosis. Body of revolution 1 and the fixed object 2 are installed in the position where the shaft orientations of the opening K for a diagnosis differ side by side, and transmission of X-ray picture data etc. is continuously performed through a lightwave signal through a lightwave transmission system in the interior of a stand 50 among these both 1 and 2 at this time. Moreover, about the signal transmission between both 1 and 2, the system represented by the slip ring 60 for others, power, and signal transmissions (for example, TOSHIBA REVIEW 1994 Vol.49 No.12) is also equipped. [lightwave transmission system / above-mentioned]
[0102] body of revolution 1 -- the shape of a cross section of U characters -- one -- or it consists of the rotation section frame which consists of an in-a-circle member fabricated individually, and is supported by the fixed object 2 free [rotation] through bearing 51 This body of revolution 1 is rotated focusing on the medial axis CX according to the motorised mechanism (not shown) represented by the belt transmission in a stand 50.
[0103] Two or more rotation section units 52--52 related with X-ray CT photography are attached in the berth side side of the shaft orientations at this body of revolution 1. Others [b / detector 52/ bulb (X-ray tube) 52a by which opposite arrangement was carried out in the position which inserts into this rotation section unit 52--52 the subject P inserted in the opening K for a diagnosis as shown in drawing 27 , and], High-voltage generator 52c which supplies the high voltage to bulb 52a, slit unit 52d for shape-of-beam adjustment of an X-ray, DAS("data collecting system") 52f, these unit 52a which carry out the minute current signal detected by oil-cooler 52e for bulb cooling, and the above-mentioned detector 52b amplification and A/D conversion -- 52h of rotation section control units which summarize 52f operation etc. is contained.
[0104] The fixed object 2 consists of the fixed part frame which consists of a cross-

section reverse [of T characters]-like member in a circle, and is arranged on the radial outside of body of revolution 1. The fixed part unit 53 about X-ray CT photography, for example, a signal receive section, is attached in this fixed object 2.

[0105] As the signal transmission of between the above-mentioned body of revolution 1 and the fixed objects 2 is carried out through light and it is shown in drawing 26 and drawing 28 , a lightwave transmission system arranges the transmitting system 3 in the optical-transmission composition 1 equivalent to each aforementioned operation gestalt, i.e., body of revolution, arranges the receiving system 4 on the fixed object 2, and grows into it. The reason which has arranged this lightwave transmission system in the tooth-back side position in a stand 50 is because the problem on part arrangement of a maintenance becoming bad when [while avoiding the noise from a high-voltage generator etc. especially,] the specific unit has been arranged to the back side of other units, for example, the rotation section unit 53--53 and was taken into consideration.

[0106] The transmitting system 3 arranges two or more laser beam discharge sections 6--6 represented by the above-mentioned 3rd operation gestalt at a fixed interval to the circumferencial direction of the side by the side of the fixed object 2 of body of revolution 1, and is formed while carrying signal transmitting former 5 [equivalent to the above 3rd - the 6th operation gestalt], and the signal distribution section 11 in DAS52f arranged at body of revolution 1 at one.

[0107] The receiving system 4 carries the signal reception place 8 in the signal receive section 53 at one while it is equipped with the light-receiving section 7 and the signal reception place 8 which are represented by the above-mentioned 2nd operation gestalt and attaches the light-receiving section 7 in the side by the side of the body of revolution 2 of the fixed object 1.

[0108] For this reason, while body of revolution 1 is rotating, light is always received by the photo detector through the plane mirrors 9 and 9 of two sheets, and the optical path length of at least one of laser beam LB--LB emitted from each laser beam discharge section 6--6 is also always equal.

[0109] Therefore, since light without an effect equivalent to each above-mentioned operation gestalt, i.e., a differential delay, can be continuously received also with this operation gestalt, it becomes possible to transmit the signal of X-ray picture data etc. to high speed further, for example.

[0110] (Octavus operation gestalt) Next, the octavus operation gestalt of this invention is explained based on drawing 29 and drawing 30 . This 7th operation gestalt is applied to the lightwave transmission system which performs data transmission from a fixed object to body of revolution contrary to the optical-transmission composition of each above-mentioned operation gestalt. a same or equivalent sign is attached and simple [in the explanation] about a component the same as that of each above-mentioned operation gestalt, or equivalent here, -- or it omits

[0111] The lightwave transmission system shown in drawing 26 and drawing 27 is the composition which has arranged the receiving system 4 to body of revolution 1, and has arranged the transmitting system 3 on the fixed object 2, and performs the signal transmission from the fixed object 2 to body of revolution 1 through the transmitting system 3 and the receiving system 4. That is, the transmitting system 3 has arranged signal transmitting former 5 [equivalent to the above-mentioned 3rd operation gestalt], two or more laser beam discharge sections 6--6, and the signal distribution section 11 on

the fixed object 1, and the receiving system 4 arranges the light-receiving section 7 equivalent to the above-mentioned 2nd operation gestalt, and the signal reception place 8 to body of revolution 1.

[0112] For this reason, while body of revolution 1 is rotating, it is reflected with the plane mirror 9 arranged at body of revolution 1, and light-receiving of at least one of laser beam LB--LB from each laser beam discharge section 6--6 arranged at the fixed object 1 is attained by the photo detector 10.

[0113] Therefore, in addition to an effect equivalent to the above-mentioned 3rd operation gestalt, with this operation gestalt, the continuous signal transmission from a fixed object to body of revolution can be performed.

[0114] In addition, the optical-transmission composition from a fixed object to body of revolution is not limited to this operation gestalt, and all optical-transmission composition contrary to each above-mentioned operation gestalt can apply it. Moreover, a signal transmission bidirectional by arranging a transmitting system and a receiving system on both body of revolution and a fixed object also becomes possible.

[0115] For example, although considered as the composition which performs the signal transmission from a fixed object to body of revolution by the system which used the slip ring in the lightwave transmission system concerning the aforementioned 7th operation gestalt, it replaces with this slip ring and a bidirectional signal transmission becomes possible by carrying the lightwave transmission system represented by this octavus operation gestalt.

[0116] Moreover, although the lightwave transmission system concerning the above 1st - an octavus operation gestalt is applied to the stand of a medical X-ray CT scanner etc., this invention is not necessarily limited to this. For example, nuclear-medicine-diagnosis equipment (PET, SPECT) etc. rotates, and the position of a shaft has a limit, and size is comparatively big and it can apply to what high-speed transmission is required as enough.

[0117] Moreover, it is not necessary to make it arrange at the predetermined intervals along with the not necessarily same circumferencial direction, and about two or more laser beam discharge sections, as long as it is the position which can emit a lightwave signal at the angle which goes to an ideal point, you may prepare in the positions where the position where radial differs, for example, the position where shaft orientations differ are arbitrary.

[0118] Moreover, the method reflected once with the plane mirror of one sheet arranged in parallel with the shaft orientations of body of revolution as the lightwave transmission system concerning the above 1st - an octavus operation gestalt is shown in drawing 31 (refer to this drawing (a)), Or although the method (refer to this drawing (b)) reflected by a unit of at least 1 time with the plane mirror of two sheets arranged in parallel with the shaft orientations of body of revolution is adopted, this invention is not limited to this.

[0119] For example, the method which may set up arbitrarily number of sheets, its arrangement angle, etc. of a plane mirror, for example, will be reflected with the plane mirror of two or more sheets if the arrangement conditions of a plane mirror based on the principle of an above-mentioned this invention are satisfied (refer to this drawing (c) and (d)) (you may adopt.) Furthermore, a plane mirror may not necessarily be limited to what has high flatness, and flatness may be the thing of a low, i.e., an abbreviation plane, comparatively depending on the conditions of the angle of divergence of a light beam. It

is because light-receiving becomes possible at the photo detector arranged at breadth within the limits of a light beam though it originated in the flatness of a plane mirror and the reflective direction of a light beam displaced when enlarging the angle of divergence of a light beam.

[0120] Furthermore, although considered as the composition supposing one ideal point with the above 1st - the octavus operation gestalt, this invention may be the composition of it necessarily not being limited to this and having assumed "two or more ideal points." Assuming "two or more ideal points" has the advantage that mean that two or more convergent points exist simultaneously, and make possible simultaneous transmission of two or more signals by arranging a photo detector individually to each of that convergent point, consequently transmission capacity of number of ideal points improves.

[0121] For example, although drawing 33 (a) and (b) have shown the concept at the time of using the plane mirror of two sheets when [most fundamental] the plane mirror of one sheet is used by drawing 32 (a) and (b) as an example of arrangement supposing two or more ideal points (signs P1 and P3 show an ideal point, and signs P2 and P4 show a convergent point) In addition, it cannot be overemphasized that it is applicable to each above-mentioned operation gestalt and its modification, and an application within limits which do not deviate from the principle of this invention.

[0122]

[Effect of the Invention] As explained above, according to the lightwave transmission system of this invention, it arranges in the position which can emit a lightwave signal at the angle which turned the luminescence section to the ideal point defined on the medial axis of body of revolution. Since the plane mirror is arranged in the position in which a lightwave signal can be reflected and the photo detector has been arranged to the convergent point of the lightwave signal which becomes settled in the arrangement position of a plane mirror, and the mutual geometrical optics-physical relationship of an ideal point, While body of revolution is rotating focusing on a medial axis to a fixed object and always being able to receive the lightwave signal by which incidence is carried out to a plane mirror from the luminescence section by the photo detector, the optical path length of the lightwave signal is maintainable in the distance between the positions and ideal points which have always arranged the fixed value, i.e., the luminescence section.

[0123] Therefore, most situations of receiving a signal with a differential delay by the photo detector are avoidable, and thereby, it becomes possible to carry out the signal transmission of between body of revolution and fixed objects at high speed, maintaining the restoration precision of a signal. The X-ray CT scanner which aimed at high-speed-data transmission can be made to demonstrate especially this effect to the maximum extent.

TECHNICAL FIELD

[The technical field to which invention belongs] This invention relates to the lightwave transmission system which started the lightwave transmission system which carries out the signal transmission of between the body of revolution and the fixed objects which are

carried in the stand of a medical X-ray CT scanner etc. through a lightwave signal, especially has arranged optical system.

PRIOR ART

[Description of the Prior Art] Conventionally, the lightwave transmission system which carries out the signal transmission of between the body of revolution and the fixed objects which have been arranged by non-contact through light is known. What devised the physical relationship of a light emitting device and a photo detector etc., and the thing which has arranged optical system between a light emitting device and a photo detector are proposed as what carries out continuation transmission for example, during rotation by this lightwave transmission system. Hereafter, both are explained based on drawing 34 and drawing 35 .

[0003] First, an example of the lightwave transmission system which has arranged the light emitting device and the photo detector is shown in drawing 34 . It is what was applied to the stand of a medical X-ray CT scanner, and the lightwave transmission system shown in this drawing equips with photo detectors (photodiode etc.) 104 the fixed part 103 fixed to the position of the radial outside of this rotation section 101 while equipping this stand 100 with two or more light emitting devices (light emitting diode or laser) 102--102 inside in the outside periphery side of the rotation section 101. The light emitting device 102--102 is arranged at the fixed interval along the periphery side of body of revolution 101, and sends simultaneously the signal of the X-ray picture data distributed through the signal distribution section 106 from signal transmitting former 105 as a lightwave signal along with the tangential direction of the periphery of the rotation section 101.

[0004] Since the array interval of a light emitting device 102 and the degree of angle of divergence of a light beam are adjusted in this lightwave transmission system so that each light beam from at least two adjoining light emitting devices 102 and 102 may be made to overlap mutually While the rotation section 101 is rotating, the light beam spread from at least one light emitting device 102 in two or more light emitting devices 102--102 is can always be received at a photo detector 104, and the electrical signal changed here is restored to the original signal at the signal reception place 107.

[0005] What set the propagation direction of a light beam as the angle towards the shaft orientations of the radial outside of a periphery or body of revolution as this type of a lightwave transmission system is proposed (for example, JP,5-253217,A).

[0006] Next, an example (for example, JP,5-220133,A) of the lightwave transmission system which has arranged the concave mirror is shown in drawing 35 . It is what applied the lightwave transmission system shown in this drawing as well as the above to the stand of a medical X-ray CT scanner, and in the interior of this stand 110, while two or more laser [which oscillates a narrow-beam-like laser beam] (light emitting device) 112--112, and signal transmitting former 113, and the signal distribution section 114 are arranged at the rotation section 111, the concave mirror 118 besides a photo detector 116 and the signal reception place 117 is formed in the fixed part 115.

[0007] While the rotation section 111 is rotating in this lightwave transmission system, Since the curved-surface state of a concave mirror 115 is adjusted so that the laser beam emitted along with the tangential direction of the periphery of the rotation section 111

from at least two adjoining laser 112 and 112 may be led to the photo detector 116 fixed to one certain point Light-receiving of the laser beam emitted from at least one light emitting device 112 in two or more light emitting devices 112--112 is always attained by the photo detector 114 through a concave mirror 115.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to the lightwave transmission system of this invention, it arranges in the position which can emit a lightwave signal at the angle which turned the luminescence section to the ideal point defined on the medial axis of body of revolution. Since the plane mirror is arranged in the position in which a lightwave signal can be reflected and the photo detector has been arranged to the convergent point of the lightwave signal which becomes settled in the arrangement position of a plane mirror, and the mutual geometrical optics-physical relationship of an ideal point, While body of revolution is rotating focusing on a medial axis to a fixed object and always being able to receive the lightwave signal by which incidence is carried out to a plane mirror from the luminescence section by the photo detector. The optical path length of the lightwave signal is maintainable in the distance between the positions and ideal points which have always arranged the fixed value, i.e., the luminescence section.
[0123] Therefore, most situations of receiving a signal with a differential delay by the photo detector are avoidable, and thereby, it becomes possible to carry out the signal transmission of between body of revolution and fixed objects at high speed, maintaining the restoration precision of a signal. The X-ray CT scanner which aimed at high-speed-data transmission can be made to demonstrate especially this effect to the maximum extent.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] however, if it was in the lightwave transmission system of the conventional technology mentioned above, since it was the composition that the distance between a light emitting device and a photo detector changed during rotation of the rotation section, and optical path length (optical path length) changed, two or more lightwave signals from which optical path length differs were received simultaneously -- it originated in the differential delay based on the optical path length difference between two or more of the lightwave signals, and a signal might be unable to be restored with a sufficient precision to a case
[0009] This problem was so remarkable that the transmission frequency of a signal

became high. Especially the lightwave transmission system with this above-mentioned is because it was not what was conscious of high-speed transmission. Moreover, the above-mentioned problem was so remarkable that the size of the rotation section became large. Light is for an optical path length difference to increase in proportion to the size of the rotation section in order to take the time for 1ns to progress 30cm.

[0010] by the way, on the other hand, in a medical X-ray CT scanner, about the X-ray picture data collected in large quantities at once with progress of the high-speed-scanning technology represented by the helical scan, an image processing and in order to make it display, it is between the body of revolution in a stand, and a fixed object for a short time, and it is important to carry out the signal transmission of the X-ray picture data etc. at high speed in recent years

[0011] However, it was difficult to apply the conventional lightwave transmission system as it is on the restoration precision of the signal transmitted with the medical X-ray CT scanner which aimed at high-speed-data transmission (for example, several 100 Mbps(es)) in this way.

[0012] it can carry out the signal transmission of between body of revolution and fixed objects at high speed, this invention having been made in consideration of the problem of the conventional technology mentioned above, and maintaining the restoration precision of a signal -- it targets to offer a lightwave transmission system Moreover, it sets it as another purpose to offer the optimal lightwave transmission system for the X-ray CT scanner which aimed at high-speed transmission.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, a lightwave transmission system according to claim 1 It considers as the composition which carries out a signal transmission through the transmitting system which sends a lightwave signal for between the body of revolution arranged by non-contact, and fixed objects, and the receiving system which receives the above-mentioned lightwave signal. While either [at least] the above-mentioned transmitting system or the above-mentioned receiving systems are prepared in the above-mentioned body of revolution, and inside [it is the above-mentioned transmitting system and a receiving system] establishes another side in the above-mentioned fixed object at least While arranging in the position which can emit the above-mentioned lightwave signal at the angle towards the ideal point which the above-mentioned transmitting system was equipped with the luminescence section which emits the above-mentioned lightwave signal, and defined this luminescence section on the medial axis of the above-mentioned body of revolution The above-mentioned receiving system is equipped with the plane mirror which reflects the above-mentioned lightwave signal, and the photo detector which receives the above-mentioned lightwave signal reflected with this plane mirror. The above-mentioned plane mirror has been arranged in the position in which the above-mentioned lightwave signal can be reflected, and the above-mentioned photo detector is arranged to the convergent point of the above-mentioned lightwave signal which becomes settled in the mutual geometrical

optics-physical relationship of the arrangement position of the above-mentioned plane mirror, and the above-mentioned ideal point.
[0014] In invention according to claim 2, the aforementioned plane mirror is a plane mirror of two or more sheets.
[0015] In invention according to claim 3, the plane mirror of two or more aforementioned sheets is a plane mirror of two sheets, has arranged one side of this plane mirror of two sheets between the positions and the aforementioned ideal points which have arranged the aforementioned luminescence section, and counters and arranges another side of the plane mirrors of the two above-mentioned sheets according to above-mentioned one side and non-contact.
[0016] In invention according to claim 4, the aforementioned luminescence sections are two or more luminescence sections.
[0017] In invention according to claim 5, the aforementioned ideal points are two or more ideal points.
[0018] In invention according to claim 6, two or more aforementioned luminescence sections are arranged at the predetermined intervals along with the circumferencial direction of the aforementioned medial axis.
[0019] In invention according to claim 7, the aforementioned photo detector has arranged the lightwave signal for two or more aforementioned luminescence sections through the aforementioned plane mirror at the same or interval smaller than the range as the range which can receive light.
[0020] In invention according to claim 8, the aforementioned photo detectors are two or more photo detectors.
[0021] The aforementioned transmitting system is equipped with a detection means to detect the positional information about the rotation position of the aforementioned body of revolution to the aforementioned fixed object, and the control means which control the luminescence stage of the aforementioned lightwave signal by the aforementioned luminescence section based on the positional information which this detection means detected in invention according to claim 9.
[0022] In invention according to claim 10, the aforementioned receiving system is further equipped with a means to add and output two or more electrical signals which two or more aforementioned photo detectors changed.
[0023] In invention according to claim 11, the aforementioned receiving system is further equipped with a means to choose and output two or more electrical signals which two or more aforementioned photo detectors changed.
[0024] In invention according to claim 12, the aforementioned receiving system is further equipped with a detection means to detect the positional information about the rotation position of the aforementioned body of revolution to the aforementioned fixed object, and a means to choose and output two or more electrical signals which two or more aforementioned photo detectors changed based on the positional information which this detection means detected.
[0025] In invention according to claim 13, the aforementioned body of revolution and the fixed object changed by the in-a-circle member installed in the position of the shaft orientations of opening for a diagnosis in the stand of an X-ray CT scanner side by side, the aforementioned luminescence section was prepared in the side of one [at least] above-mentioned shaft orientations of the above-mentioned body of revolution and the

fixed objects, and inside [it is the above-mentioned body of revolution and a fixed object] has prepared the aforementioned photo detector and the plane mirror in the side of the above-mentioned shaft orientations of another side at least.

[0026]

[Embodiments of the Invention] The principle of the lightwave transmission system concerning this invention common to each following operation gestalt is explained to the beginning based on drawing 1 - drawing 4 .

[0027] Drawing 1 explains the light reflex path when making one laser beam (it being hereafter called a "ideal point") emit towards P1, and reflecting each laser beam with a plane mirror M1 temporarily defined from the position where each laser Lx has been arranged, and optical path length supposing n laser Lx (x= 1, 3 [2 and 3], --, n (it is below the same)) arranged in the same field.

[0028] As shown in this drawing, each laser beam which carried out incidence to the plane mirror M1 is reflected at the angle which always becomes symmetrical with an ideal point P1 and a field on both sides of a plane mirror M1 by geometrical optics rectilinear propagation and reflexive law of a beam of light even if it is in which incidence position Rx and which goes to P2 one point (it is hereafter called a "convergent point"). therefore, each optical path length from each laser Lx to a convergent point P2 -- dx -- carrying out -- a segment -- the time of setting each length of LxRx to ax, setting each length of a segment RxP2 to bx, and setting each length of a segment RxP1 to cx -- bx=cx and a bird clapper to the optical path length dx -- [Equation 1] dx=ax+cx=ax+bx .... (1)

It is expressed by the ** type. That is, the optical path length dx is equal to the optical path length to the ideal point P1 when presupposing that there is no plane mirror M1.

[0029] Therefore, in this invention, it noted that the convergent point based on the mutual geometrical optics-physical relationship of an ideal point and a plane mirror surely exists, and being equal to the optical path length to an ideal point when the optical path length to the convergent point presupposes that there is no plane mirror.

[0030] Although the above-mentioned physical relationship is an example which has arranged the plane mirror of one sheet, when the plane mirror of two or more sheets has been arranged, it is materialized similarly. For example, if a plane mirror M1 and another plane mirror M2 between convergent points P2 are arranged as shown in drawing 1 , each laser beam which carried out incidence to the plane mirror M2 will be reflected on both sides of a plane mirror M2 at the angle which goes to a convergent point P2 and the new convergent point P3 which becomes symmetrical with a field (refer to the two-dot chain line in drawing 1). Therefore, each optical path length to a convergent point P3 is equal to each optical path length to the ideal point P1 when presupposing that there is none of each optical path length dx M1 to the convergent point P2 when presupposing that there is no plane mirror M2, i.e., a plane mirror.

[0031] Although the above-mentioned physical relationship is the example of the laser arranged in the same side, as shown in drawing 2 , it is similarly materialized about two or more laser Lx arranged in space. This physical relationship is examined based on drawing 3 .

[0032] First, two laser L1 and L2 is arranged in the XYZ space shown in drawing 3 , and it considers as the angle which turned the sense of each of that laser L1 and L2 at the point (ideal point) P1, and suppose that the plane mirror M has been arranged on XY flat

surface between the each laser L1 and L2 and ideal point P1.
[0033] Here, it is [Equation 2] about each unit vectors A1 and B1 of the direction of the light which carries out incidence to a plane mirror M. A1= (a1, a2, a3) .... (2)
[Equation 3] B1= (b1, b2, b3) .... the coordinate of (3) -- expressing -- the intersection P1 of the extension wire of each of these unit vectors A1 and B1, i.e., a point, -- [Equation 4] P1= (p1, p2, p3) .... (4)
Each unit vector A2 of the direction of light reflected with the plane mirror M when expressed with ******, and B-2 are [Equation 5]. A2= (a1, a2, -a3) .... (5)
[Equation 6] B-2= (b1, b2, -b3) .... (6)
It becomes ******. Therefore, while the extension wire of each unit vector A2 and B-2 crosses at a point P2 (convergent point) from above-mentioned (2) - (6), this point P2 is [Equation 7]. P2= (p1, p2, -p3) .... (7)
From ****** and a bird clapper, an above-mentioned convergent point and the point about optical path length paying their attention are materialized about the plane mirror arranged at the laser arranged in space, and arbitrary angles. That is, if the sense of laser is an angle towards the ideal point, it is good at arbitrary angles, and if the sense of the plane mirror to the laser is also in the state in which incidence is possible about light, it is good at arbitrary angles. Moreover, it is the same when carrying out multiple-times reflection of the light using the plane mirror of two or more sheets.
[0034] The above point paying its attention is similarly materialized, as long as the angle towards the ideal point is being maintained, even if it moves the position of laser. If laser is moved where the distance between laser and an ideal point is maintained especially uniformly, the position of a convergent point not only does not change, but the optical path length to the convergent point will become fixed. For example, if the conditions to which laser L1 is moved along with the circumferencial direction centering on an ideal point P1 are considered as shown in drawing 4 , while reflecting the laser beam by which incidence was carried out to the plane mirror M from each move position Ax at the angle which always goes to a convergent point P2, each optical path length to a convergent point P2 always maintains the optical path length r to an ideal point P1, i.e., a radius.
[0035] Hereafter, the operation form of this invention is explained one by one.
[0036] (The 1st operation form) The 1st operation form of this invention is first explained based on drawing 5 - drawing 8 . The lightwave transmission system concerning this 1st operation form is [most fundamental] applicable to a medical X-ray CT scanner based on the principle of above-mentioned invention.
[0037] Drawing 5 explains the arrangement situation of the body of revolution 1 in which the lightwave transmission system was carried, and the fixed object 2. the frame in housing with which body of revolution 1 changes from the in-a-circle member which has opening (it omits for convenience in each following drawing) to the medial axis CX, and the fixed object 2 supports body of revolution 1 free [rotation] as shown in this drawing -- it consists of a member etc.
[0038] The lightwave transmission system shown in drawing 6 and drawing 7 is the composition which has arranged the transmitting system 3 which sends a lightwave signal to body of revolution 1, and has arranged the receiving system 4 which receives a lightwave signal in the fixed object 2, and performs the signal transmission through the light from the body of revolution 1 to the fixed object 2.
[0039] The transmitting system 3 is equipped with signal transmitting former 5 which

supplies the signal S1 for transmission, and the laser beam discharge section (the luminescence section of this invention is accomplished) 6 which changes the signal S1 from this signal transmitting former 5 into a lightwave signal, and is emitted as a beam-like laser beam LB.

[0040] The laser beam discharge section 6 consists of laser, such as a laser diode, and is fixed to the side of the shaft orientations of body of revolution 1. In this laser beam discharge section 6, the discharge angle (the direction of the center line of a beam) of a laser beam LB is set as the angle which goes to the ideal point P1 defined on the medial axis CX. (Refer to the signs a and b in drawing 8 , and c) . That is, the physical relationship of the laser beam discharge section 6 and an ideal point P1 becomes equivalent to the physical relationship of the base periphery section of a right circular cone, and the peak. Therefore, this laser beam discharge section 6 always emits the beam-like laser beam LB at the fixed angle which goes to an ideal point P1, while body of revolution 1 is rotating.

[0041] The receiving system 4 is equipped with the light-receiving section 7 which changes a laser beam LB into an electrical signal, and receives it from the laser beam discharge section 6, and the signal reception place 8 which changes into the original signal S1 the electrical signal changed in this light-receiving section 7 (restoration).

[0042] The light-receiving section 7 is equipped with the plane mirror 9 which reflects the laser beam from the laser beam discharge section 6, and the photo detector 10 which receives the laser beam reflected with this plane mirror 9.

[0043] A plane mirror 9 is arranged between the laser beam discharge section 6 and an ideal point P1, and is fixed to the fixed object 1 at the angle with the reflector parallel to the shaft orientations of body of revolution 1. This plane mirror 9 carries out incidence of the laser beam LB, when the laser beam discharge section 6 is in a predetermined rotation position (it is hereafter called a "light-receiving position" for convenience), and it reflects this in a photo-detector 10 side.

[0044] It consists of a photodiode and a photo detector 10 is arranged in the above-mentioned convergent point P2 which becomes settled in the mutual physical relationship of the position and ideal point P1 by which the plane mirror 9 has been arranged. The feeble current signal changed by the photo detector 10 is outputted to the signal reception place 8.

[0045] Next, an operation of this whole operation gestalt is explained.

[0046] First, body of revolution 2 presupposes that it rotated focusing on the medial axis CX, and the laser discharge section 6 rotated to the light-receiving section 7 in connection with this to the fixed object 2. It is emitted at the angle which the signal from signal transmitting former 8 is changed into a lightwave signal in the laser beam discharge section 6, and goes to an ideal point P1 as a laser beam LB in this state.

[0047] Here, when the laser discharge section 6 is in a light-receiving position, light-receiving of a laser beam LB is attained at the photo detector 10 arranged through a plane mirror 9 at the convergent point P2. At this time, the optical path length of a laser beam LB is equal to the distance to the ideal point P1 when presupposing that there is no plane mirror 9, and always fixed regardless of the position of the laser beam discharge section 6.

[0048] Therefore, while the laser beam LB by which incidence is carried out to a plane mirror 9 while the laser discharge section 6 is rotating is always led to a photo detector

10, the situation of receiving the signal with which a photo detector 9 has a differential delay since it is always fixed regardless of the position of the laser beam discharge section 6 also for the optical path length almost comes to be avoided. Thereby, maintaining the restoration precision of a signal, the transmission frequency of a signal can be raised and it becomes possible to attain high-speed transmission-ization.
[0049] Moreover, secondarily, since the plane mirror was adopted as optical system, compared with a comparatively expensive concave mirror with the complicated and former, there is also an advantage that it can manufacture easily and comparatively cheaply.
[0050] In addition, although the beam-like laser beam is used with this operation gestalt, the light beam which is not limited to this and has fixed angles of divergence, such as the shape of a cone, is sufficient as this invention. Therefore, the composition using light emitting devices, such as light emitting diode which is not limited to the composition which used laser and emits a light beam, is sufficient as the luminescence section.
[0051] Moreover, a detection means to detect the positional information of body of revolution to a fixed object as an application of this operation gestalt (let a sensor be an important section), So that a lightwave signal may be sent based on the positional information which this detection means detected, when the rotation position of the laser beam discharge section is located in a lightwave signal in the light-receiving position which can be transmitted to the light-receiving section You may add the control means which control the drive timing of the signal supply and a halt to the laser beam discharge section from signal transmitting origin to body of revolution.
[0052] Moreover, as another application, the halt position of body of revolution is beforehand set as a light-receiving position, and when this body of revolution stops, you may add the composition which performs a signal transmission.
[0053] (The 2nd operation gestalt) Nëxt, the 2nd operation gestalt of this invention is explained based on drawing 9 and drawing 10 . This 2nd operation gestalt arranges the plane mirror of two sheets in the above-mentioned light-receiving section. a sign the same about a component the same as that of the above-mentioned 1st operation gestalt or equivalent here or equivalent is attached, and simple in the explanation -- or it omits
[0054] The lightwave transmission system shown in drawing 9 and drawing 10 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from the body of revolution 1 to the fixed object 2 through the transmitting system 3 and the receiving system 4. The transmitting system 3 is equipped with the one laser beam discharge section 6, and the receiving system 4 is equipped with the one light-receiving section 7.
[0055] The light-receiving section 7 is equipped with the plane mirrors 9 and 9 of two sheets, and one photo detector 10, counters and installs the plane mirrors 9 and 9 of two sheets in the position where radial [of the medial axis CX of body of revolution 1] differs side by side, arranges a photo detector 10 to the convergent point P2 which becomes settled in the physical relationship of the position of the plane mirrors 9 and 9 of two sheets, and an ideal point P1, and is formed in it.
[0056] Here, when the laser beam discharge section 6 is in a light-receiving position, the laser beam LB reflected with the plane mirrors 9 and 9 of two sheets is always led to a photo detector 10, and the optical path length is also always equal to the distance between

the fixed value 6, i.e., the laser beam discharge section, and an ideal point P1.
[0057] therefore, with this operation gestalt, there is an advantage which can build compactly the stand of a making [in addition to an effect equivalent to the above-mentioned 1st operation gestalt / the space in a stand which arrangement of the light-receiving section takes, especially the radial space of a stand / small in each stage] shell, and a medical X-ray CT scanner
[0058] (The 3rd operation gestalt) Next, the 3rd operation gestalt of this invention is explained based on drawing 11 and drawing 12 . The lightwave transmission system concerning this 3rd operation gestalt arranges two or more laser beam discharge sections and the one light-receiving section, and aims at continuation transmission. a sign the same about a component the same as that of the above-mentioned 1st operation gestalt or equivalent here or equivalent is attached, and simple in the explanation -- or it omits
[0059] The lightwave transmission system shown in drawing 11 and drawing 12 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from body of revolution 1 to a fixed object through the transmitting system 3 and the receiving system 4. The receiving system 4 equips the one light-receiving section 7 equivalent to the above-mentioned 1st operation gestalt with a plane mirror 9 and a photo detector 10.
[0060] The transmitting system 3 is equipped with the signal distribution section, signal transmitting former 5 which supplies a signal S1, and the plurality 6--6 arranged at the fixed interval in the outside periphery section of body of revolution 1, for example, the six laser beam discharge sections, 11 which distributes the signal S1 from signal transmitting former 5 to two or more laser discharge sections 6--6.
[0061] The signal distribution section 11 consists of a predetermined signal distribution circuit, distributes the signal S1 serially supplied from signal transmitting former 5 according to the number of the laser discharge section 6--6 as it is, and supplies this to each laser discharge section 6--6 individually.
[0062] The laser beam discharge section 6--6 arranges the laser of plurality (for example, six pieces) at a fixed interval to the circumferencial direction of body of revolution 1, and changes, and all the discharge directions of laser beam LB--LB are set as the angle which goes to an ideal point P1. In order to perform continuation transmission on the fixed object 2 from body of revolution 1, as for the array interval of this laser beam discharge section 6--6, it is desirable for the light-receiving section 7 to set up smaller [it is equal to the range which can receive a laser beam, or] than the range.
[0063] For this reason, while body of revolution 1 is rotating to the fixed object 2, light-receiving of at least one of two or more laser beam LB--LB from two or more laser beam discharge sections 6--6 is attained by the photo detector 9 through a plane mirror 10.
[0064] Therefore, in addition to an effect equivalent to the above-mentioned 1st operation form, with this operation form, there is an advantage which can perform continuation transmission of the signal from body of revolution to a fixed object.
[0065] In addition, although considered as the composition which has arranged laser individually in two or more laser beam discharge sections 6--6 with this operation form, this invention is not necessarily limited to this.
[0066] For example, arrange one laser in the signal distribution section 11, and two or more optical fibers which responded to the number of the laser beam discharge sections

6--6 at the signal distribution section 11 are connected. You may be the composition to which supply the transmission signal through light to each laser beam discharge section 6--6 individually through each optical fiber from the signal distribution section 11, and a laser beam is made to emit indirectly through optical system, such as a lens, directly from the point of the optical fiber. In this case, in order to make all the laser beam discharge sections 6--6 emit light simultaneously depending on the transmission frequency of a signal, it is desirable to make equal all the path length of each optical fiber from the signal distribution section 11 to the laser beam discharge section 6--6.

[0067] (The 4th operation form) Next, the 4th operation form of this invention is explained based on drawing 13 - drawing 16 . The lightwave transmission system concerning this 4th operation form arranges two or more laser beam discharge sections and two or more light-receiving sections. a sign the same about a component the same as that of each above-mentioned operation form or equivalent here or equivalent is attached, and simple in the explanation -- or it omits

[0068] The lightwave transmission system shown in drawing 13 and drawing 14 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from the body of revolution 1 to the fixed object 2 through the transmitting system 3 and the receiving system 4. Moreover, body of revolution 1 is equipped with the rotation position detection system 20 which detects the rotation position of the body of revolution 1 to the fixed object 2 to this lightwave transmission system.

[0069] The receiving system 4 equips with the two light-receiving sections 7a and 7b the position (angular position of 180 degrees centering on a medial axis) which counters on both sides of the medial axis CX of body of revolution 1, and equips each of the two light-receiving sections 7a and 7b with a plane mirror 9 and a photo detector 10.

[0070] The transmitting system 3 is equipped with signal transmitting former 5 which supplies two transmission signals S1 and S2 in the independent path, the laser beam discharge section [two or more (for example, six pieces)] 6--6 equivalent to the above-mentioned 3rd operation form, and the signal distribution section 11 which distributes the transmission signals S1 and S2 from signal transmitting former 5 to each laser discharge section 6--6.

[0071] As shown in drawing 15 , from signal transmitting former 5, the signal distribution section 11 distributes individually either of the two signals S1 and S2 supplied to parallel to each laser beam discharge section 6--6, supplies it to it, and is equipped with the signal change section 12 for switching two signals S1 and S2.

[0072] It consists of change-over switches, such as a multiplexer, and the signal change section 12 performs switching about the supply start of two signals S1 and S2 given every laser beam discharge section 6--6, a halt, and a change based on the control signal from the rotation position detection system 20.

[0073] The rotation position detection system 20 is equipped with two or more plates 21--21 arranged at the fixed interval at the circumferencial direction at the inner skin of the fixed object 2 which counters the outside periphery section of body of revolution 1, the sensors 22, such as a photosensor for positional information detection arranged at the outside periphery section of body of revolution 1 so that this plate 21--21 may be crossed, and the angle Monitoring Department 23 which supervises the positional information of this sensor 22 as shown in drawing 16 .

[0074] A sensor 22 is crossing two or more plates 21--21 arranged at the fixed object 2 while body of revolution's 1 rotates, detects the positional information of body of revolution 1 to the fixed object 2 with the resolution proportional to this number of plates, and outputs this to the angle Monitoring Department 23.
[0075] The angle Monitoring Department 23 so that only the signal S1 which is always one side in one light-receiving section 7a may be received based on the detecting signal from a sensor 22 while each laser beam discharge section 6--6 rotates, and only the signal S2 of another side may be received in light-receiving section 7b of another side The supply start of the signals S1 and S2 given to each laser beam discharge section 6--6, its halt, and the control signal about switch time are supplied to the signal distribution section 12.
[0076] For this reason, while body of revolution 1 is rotating to the fixed object 2, while is supplied from signal transmitting former 5, and while a signal S1 is received by light-receiving section 7a which is always one side, the signal S2 of another side is also always received by light-receiving section 7b of another side.
[0077] therefore, with this operation form, since the predetermined signal of two or more signals of signal transmitting origin is always received in the predetermined light-receiving section according to the rotation position of the body of revolution to a fixed object in addition to an effect equivalent to the above-mentioned 1st operation form, there is an advantage which can carry out the parallel transmission of two or more signals to **** continuously
[0078] In addition, although the plate and the sensor are adopted as the rotation position detection system with this operation form, in this invention, it may not necessarily be limited to this, and the composition using the encoder etc. may be used.
[0079] Moreover, with this operation form, although the rotation position detection system is prepared in body of revolution, this invention is not necessarily limited to this and may prepare a rotation position detection system in a fixed object. In this case, what is necessary is to arrange a sensor on a fixed object, to arrange a plate to body of revolution, and just to detect angle of rotation by the fixed object side. Moreover, you may measure angle of rotation of body of revolution by attaching an encoder to the drive motor carried in the rolling mechanism of a fixed object, and detecting the rotation position of the drive motor with an encoder.
[0080] (The 5th operation form) Next, the 5th operation form of this invention is explained based on drawing 17 - drawing 19 . The lightwave transmission system concerning this 5th operation form arranges two or more laser beam discharge sections and two or more light-receiving sections. a same or equivalent sign is attached and simple [in the explanation] about a component the same as that of the 1st operation form, or equivalent here, -- or it omits
[0081] The lightwave transmission system shown in drawing 17 and drawing 18 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from the body of revolution 1 to the fixed object 2 through the transmitting system 3 and the receiving system 4. Moreover, the fixed object 2 is equipped with the rotation position detection system 20 at this lightwave transmission system.
[0082] The rotation position detection system 20 arranges a plate (not shown) equivalent to the above-mentioned 4th operation form to body of revolution, stations the sensor 22

equivalent to the above-mentioned 4th operation form, and the angle Monitoring Department 23 on a fixed object, changes, and supplies the control signal by the angle Monitoring Department 23 to the receiving system 4.
[0083] The receiving system 4 is equipped with the three light-receiving sections 7a, 7b, and 7c arranged at the fixed interval (for example, 120 degrees centering on a medial axis CX) at the outside periphery section of body of revolution 1, and the signal reception place 8 which receives the feeble current signal changed by each of this light-receiving section 7a--7c.
[0084] The signal reception place 8 is based on a control signal from the angle Monitoring Department 23, as shown in drawing 19 , and it is three light-receiving section 7a. -- The light-receiving section as which it was instructed of the 7c is chosen, and it has the signal change section 13 which consists of change-over switches, such as a multiplexer which switches the signal from the light-receiving section to an input signal.
[0085] The transmitting system 3 equips the position which sandwiches signal transmitting former 5 which supplies a signal S1, and the medial axis CX of body of revolution 1 with the two laser beam discharge sections 6 and 6 by which opposite arrangement was carried out, and the signal distribution section 11 which distributes simultaneously the signal S1 from signal transmitting former 5 to the two laser discharge sections 6 and 6. The array interval of the laser beam discharge sections 6 and 6 is set up more greatly than the range in which the one light-receiving section can receive a laser beam LB.
[0086] For this reason, at least one side of the laser beams LB and LB from the two laser beam discharge while body of revolution 1 is rotating sections 6 and 6 is three light-receiving section 7a. -- Light-receiving becomes possible at at least one of 7c, and only the feeble current signal changed in the light-receiving section in which the light-receiving is possible is always chosen as an input signal, and is restored to the original signal S1.
[0087] Therefore, in addition to an effect equivalent to the above-mentioned 4th operation form, with this operation form, there is an advantage which can cut down the number of the laser beam discharge sections required for continuation transmission.
[0088] In addition, they are three light-receiving section 7a as an application of this 5th operation form. -- The case where the plane mirrors 9 and 9 of two sheets have been individually arranged to 7c is shown in drawing 20 and drawing 21 . In this case, the space which the light-receiving section takes can be made small, and there is an advantage which can build equipment itself compactly.
[0089] (The 6th operation form) Next, the 6th operation form of this invention is explained based on drawing 22 - drawing 24 . The lightwave transmission system concerning this 6th operation form arranges two or more laser beam discharge sections and two or more light-receiving sections. a sign the same about a component the same as that of each above-mentioned operation form or equivalent here or equivalent is attached, and simple in the explanation -- or it omits
[0090] The lightwave transmission system shown in drawing 22 and drawing 23 is the composition which has arranged the transmitting system 3 to body of revolution 1, and has arranged the receiving system 4 on the fixed object 2, and performs the signal transmission from the body of revolution 1 to the fixed object 2 through the transmitting system 3 and the receiving system 4. The transmitting system 3 is composition equivalent

to the above-mentioned 3rd operation gestalt.
[0091] The receiving system 4 is equipped with the two light-receiving sections 7a and 7b equivalent to the above-mentioned 4th operation gestalt, and the signal reception place 8 which receives the feeble current signal changed in both the light-receiving sections 7a and 7b, and the signal reception place 8 is equipped with the signal selection circuitry 30 to which either of the signals individually inputted from the two light-receiving sections 7a and 7b is made to choose and output.
[0092] The error supervisory circuits 31 and 31 individually connected to each output side of the two light-receiving sections 7a and 7b as the signal selection circuitry 30 is shown in drawing 24 , The switch control circuit 32 which operates in response to the control signal from these error supervisory circuits 31 and 31, Based on the control signal from this switch control circuit 32, with the composition equipped with the signal change section 33 which consists of change-over switches, such as a multiplexer which switches an input signal When a transmission error occurs, the signal of the side which the transmission error has not generated is chosen and this is made to output as an input signal.
[0093] It judges whether the error supervisory circuit 31 has reception for example, within a predetermined period, and consists of the transmission error detection circuit which adopted sign collating methods, such as a circuit which detects the generating existence of a transmission error according to the judgment result, or CRC (CyclicRedundancy Check), and the control signal about the generating existence of a transmission error is supplied to the switch control circuit 32.
[0094] Therefore, with this operation gestalt, since the signal-transmission path was duplex-ized in addition to the effect equivalent to each above-mentioned operation gestalt, the laser beam discharge section, failure of a photo detector, and a gap of alignment can be coped with, and, thereby, the transmission data security of a system comes to improve sharply.
[0095] In addition, as an application of this operation gestalt, a signal adder circuit may be established in a signal transmission place, and the circuitry which makes an input signal the signal added in the signal adder circuit may be adopted. An example of this signal adder circuit is shown in drawing 25 .
[0096] The signal adder circuit 40 shown in drawing 25 equips the output side of two photodiodes (photo detector) 10 and 10 with the current-voltage conversion amplifier 41 and a comparator 42.
[0097] It consists of an operational amplifier and the I-V converter which carried the feedback resistance Rf, and the current-voltage conversion amplifier 41 transforms into a voltage signal Vs (Vs=Rf (Is1+Is2)) the current signal (Is1+Is2) adding the feeble current signals Is1 and Is2 changed by each photodiodes 10 and 10, and outputs it to a comparator 42.
[0098] A comparator 42 consists of the comparator circuit which carried the operational amplifier, compares mutually the output voltage Vs and reference voltage Vref from current-voltage conversion amplifier, and outputs the voltage signal V of the digital variable according to the size of the comparison result as an input signal.
[0099] In addition, although considered as the composition which adds and outputs each signal from two or more light-receiving sections in this application, when the number of the light-receiving sections is one, for example, a photodiode can be set to one and a

digital signal can be taken out similarly. In this case, you may carry a signal adder circuit in the light-receiving section at one. Moreover, a signal adder circuit may be composition added in a logical-addition circuit, after changing the electrical signal from a photodiode into a digital signal.

[0100] (The 7th operation gestalt) Next, the 7th operation gestalt of this invention is explained based on drawing 26 - drawing 28 . This 7th operation gestalt carries and carries out the lightwave transmission system which performs the signal transmission from body of revolution to a fixed object to the stand of a medical CT scanner. a same or equivalent sign is attached and simple [in the explanation] about a component the same as that of the above 1st - 6 real gestalten, or equivalent here, -- or it omits

[0101] In the medical X-ray CT scanner carrying the stand 50 and berth 60 which are shown in drawing 26 , the berth 60 which carried Subject P moves to the shaft orientations of the opening K for a diagnosis of a stand 50, and X-ray CT photography of Subject P is performed by this opening K for a diagnosis. Body of revolution 1 and the fixed object 2 are installed in the position where the shaft orientations of the opening K for a diagnosis differ side by side, and transmission of X-ray picture data etc. is continuously performed through a lightwave signal through a lightwave transmission system in the interior of a stand 50 among these both 1 and 2 at this time. Moreover, about the signal transmission between both 1 and 2, the system represented by the slip ring 60 for others, power, and signal transmissions (for example, TOSHIBA REVIEW 1994 Vol.49 No.12) is also equipped. [lightwave transmission system / above-mentioned]

[0102] body of revolution 1 -- the shape of a cross section of U characters -- one -- or it consists of the rotation section frame which consists of an in-a-circle member fabricated individually, and is supported by the fixed object 2 free [rotation] through bearing 51 This body of revolution 1 is rotated focusing on the medial axis CX according to the motorised mechanism (not shown) represented by the belt transmission in a stand 50.

[0103] Two or more rotation section units 52--52 related with X-ray CT photography are attached in the berth side side of the shaft orientations at this body of revolution 1. Others [b / detector 52/ bulb (X-ray tube) 52a by which opposite arrangement was carried out in the position which inserts into this rotation section unit 52--52 the **-ed person P inserted in the opening K for a diagnosis as shown in drawing 27 , and], High-voltage generator 52c which supplies the high voltage to bulb 52a, slit unit 52d for shape-of-beam adjustment of an X-ray, DAS("data collecting system") 52f, these unit 52a which carry out the minute current signal detected by oil-cooler 52e for bulb cooling, and the above-mentioned detector 52b amplification and A/D conversion -- 52h of rotation section control units which summarize 52f operation etc. is contained.

[0104] The fixed object 2 consists of the fixed part frame which consists of a cross-section reverse [of T characters]-like member in a circle, and is arranged on the radial outside of body of revolution 1. The fixed part unit 53 about X-ray CT photography, for example, a signal receive section, is attached in this fixed object 2.

[0105] As the signal transmission of between the above-mentioned body of revolution 1 and the fixed objects 2 is carried out through light and it is shown in drawing 26 and drawing 28 , a lightwave transmission system arranges the transmitting system 3 in the optical-transmission composition 1 equivalent to each aforementioned operation gestalt, i.e., body of revolution, arranges the receiving system 4 on the fixed object 2, and grows

into it. The reason which has arranged this lightwave transmission system in the tooth-back side position in a stand 50 is because the problem on part arrangement of a maintenance becoming bad when [while avoiding the noise from a high-voltage generator etc. especially,] the specific unit has been arranged to the back side of other units, for example, the rotation section unit 53--53 and was taken into consideration.
[0106] The transmitting system 3 arranges two or more laser beam discharge sections 6--6 represented by the above-mentioned 3rd operation gestalt at a fixed interval to the circumferencial direction of the side by the side of the fixed object 2 of body of revolution 1, and is formed while carrying signal transmitting former 5 [equivalent to the above 3rd - the 6th operation gestalt], and the signal distribution section 11 in DAS52f arranged at body of revolution 1 at one.
[0107] The receiving system 4 carries the signal reception place 8 in the signal receive section 53 at one while it is equipped with the light-receiving section 7 and the signal reception place 8 which are represented by the above-mentioned 2nd operation gestalt and attaches the light-receiving section 7 in the side by the side of the body of revolution 2 of the fixed object 1.
[0108] For this reason, while body of revolution 1 is rotating, light is always received by the photo detector through the plane mirrors 9 and 9 of two sheets, and the optical path length of at least one of laser beam LB--LB emitted from each laser beam discharge section 6--6 is also always equal.
[0109] Therefore, since light without an effect equivalent to each above-mentioned operation gestalt, i.e., a differential delay, can be continuously received also with this operation gestalt, it becomes possible to transmit the signal of X-ray picture data etc. to high speed further, for example.
[0110] (Octavus operation gestalt) Next, the octavus operation gestalt of this invention is explained based on drawing 29 and drawing 30 . This 7th operation gestalt is applied to the lightwave transmission system which performs data transmission from a fixed object to body of revolution contrary to the optical-transmission composition of each above-mentioned operation gestalt. a same or equivalent sign is attached and simple [in the explanation] about a component the same as that of each above-mentioned operation gestalt, or equivalent here, -- or it omits
[0111] The lightwave transmission system shown in drawing 26 and drawing 27 is the composition which has arranged the receiving system 4 to body of revolution 1, and has arranged the transmitting system 3 on the fixed object 2, and performs the signal transmission from the fixed object 2 to body of revolution 1 through the transmitting system 3 and the receiving system 4. That is, the transmitting system 3 has arranged signal transmitting former 5 [equivalent to the above-mentioned 3rd operation gestalt], two or more laser beam discharge sections 6--6, and the signal distribution section 11 on the fixed object 1, and the receiving system 4 arranges the light-receiving section 7 equivalent to the above-mentioned 2nd operation gestalt, and the signal reception place 8 to body of revolution 1.
[0112] For this reason, while body of revolution 1 is rotating, it is reflected with the plane mirror 9 arranged at body of revolution 1, and light-receiving of at least one of laser beam LB--LB from each laser beam discharge section 6--6 arranged at the fixed object 1 is attained by the photo detector 10.
[0113] Therefore, in addition to an effect equivalent to the above-mentioned 3rd

operation gestalt, with this operation gestalt, the continuous signal transmission from a fixed object to body of revolution can be performed.

[0114] In addition, the optical-transmission composition from a fixed object to body of revolution is not limited to this operation gestalt, and all optical-transmission composition contrary to each above-mentioned operation gestalt can apply it. Moreover, a signal transmission bidirectional by arranging a transmitting system and a receiving system on both body of revolution and a fixed object also becomes possible.

[0115] For example, although considered as the composition which performs the signal transmission from a fixed object to body of revolution by the system which used the slip ring in the lightwave transmission system concerning the aforementioned 7th operation gestalt, it replaces with this slip ring and a bidirectional signal transmission becomes possible by carrying the lightwave transmission system represented by this octavus operation gestalt.

[0116] Moreover, although the lightwave transmission system concerning the above 1st - an octavus operation gestalt is applied to the stand of a medical X-ray CT scanner etc., this invention is not necessarily limited to this. For example, nuclear-medicine-diagnosis equipment (PET, SPECT) etc. rotates, and the position of a shaft has a limit, and size is comparatively big and it can apply to what high-speed transmission is required as enough.

[0117] Moreover, it is not necessary to make it arrange at the predetermined intervals along with the not necessarily same circumferencial direction, and about two or more laser beam discharge sections, as long as it is the position which can emit a lightwave signal at the angle which goes to an ideal point, you may prepare in the positions where the position where radial differs, for example, the position where shaft orientations differ are arbitrary.

[0118] Moreover, the method reflected once with the plane mirror of one sheet arranged in parallel with the shaft orientations of body of revolution as the lightwave transmission system concerning the above 1st - an octavus operation gestalt is shown in drawing 31 (refer to this drawing (a)), Or although the method (refer to this drawing (b)) reflected by a unit of at least 1 time with the plane mirror of two sheets arranged in parallel with the shaft orientations of body of revolution is adopted, this invention is not limited to this.

[0119] For example, the method which may set up arbitrarily number of sheets, its arrangement angle, etc. of a plane mirror, for example, will be reflected with the plane mirror of two or more sheets if the arrangement conditions of a plane mirror based on the principle of an above-mentioned this invention are satisfied (refer to this drawing (c) and (d)) (you may adopt.) Furthermore, a plane mirror may not necessarily be limited to what has high flatness, and flatness may be the thing of a low, i.e., an abbreviation plane, comparatively depending on the conditions of the angle of divergence of a light beam. It is because light-receiving becomes possible at the photo detector arranged at breadth within the limits of a light beam though it originated in the flatness of a plane mirror and the reflective direction of a light beam displaced when enlarging the angle of divergence of a light beam.

[0120] Furthermore, although considered as the composition supposing one ideal point with the above 1st - the octavus operation gestalt, this invention may be the composition of it necessarily not being limited to this and having assumed "two or more ideal points." Assuming "two or more ideal points" has the advantage that mean that two or more

convergent points exist simultaneously, and make possible simultaneous transmission of two or more signals by arranging a photo detector individually to each of that convergent point, consequently transmission capacity of number of ideal points improves.
[0121] For example, although drawing 33 (a) and (b) have shown the concept at the time of using the plane mirror of two sheets when [most fundamental] the plane mirror of one sheet is used by drawing 32 (a) and (b) as an example of arrangement supposing two or more ideal points (signs P1 and P3 show an ideal point, and signs P2 and P4 show a convergent point) In addition, it cannot be overemphasized that it is applicable to each above-mentioned operation gestalt and its modification, and an application within limits which do not deviate from the principle of this invention.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The conceptual diagram explaining the principle of the lightwave transmission system in this invention.
[Drawing 2] The conceptual diagram explaining the principle of the lightwave transmission system concerning this invention.
[Drawing 3] The conceptual diagram explaining the principle of the lightwave transmission system concerning this invention.
[Drawing 4] The conceptual diagram explaining the principle of the lightwave transmission system concerning this invention.
[Drawing 5] The outline perspective diagram showing the example of composition of the body of revolution in which the lightwave transmission system concerning this invention was carried, and a fixed object.
[Drawing 6] Outline front view showing the composition of the lightwave transmission system in the 1st operation gestalt.
[Drawing 7] The outline side elevation seen along with A-A of drawing 6 .
[Drawing 8] The outline perspective diagram explaining the physical relationship of the laser beam discharge section.
[Drawing 9] Outline front view showing the composition of the lightwave transmission system in the 2nd operation gestalt.
[Drawing 10] The outline side elevation seen along with B-B of drawing 9 .
[Drawing 11] Outline front view showing the composition of the lightwave transmission system in the 3rd operation gestalt.
[Drawing 12] The outline side elevation seen along with C-C of drawing 11 .
[Drawing 13] Outline front view showing the composition of the lightwave transmission system in the 4th operation gestalt.
[Drawing 14] The outline side elevation seen along with D-D of drawing 13 .
[Drawing 15] Outline front view showing the example of composition of a rotation position detection system.
[Drawing 16] The outline block diagram showing the example of composition of the

signal distribution section.
[Drawing 17] Outline front view showing the composition of the lightwave transmission system in the 5th operation gestalt.
[Drawing 18] The outline side elevation seen along with E-E of drawing 17 .
[Drawing 19] The outline block diagram showing the example of composition of the signal change section in a signal reception place.
[Drawing 20] Outline front view showing the composition of the lightwave transmission system in the application of the 5th operation gestalt.
[Drawing 21] The outline side elevation seen along with F-F of drawing 20 .
[Drawing 22] Outline front view showing the composition of the lightwave transmission system in the 6th operation gestalt.
[Drawing 23] The outline side elevation seen along with G-G of drawing 22 .
[Drawing 24] The outline block diagram showing the example of composition of the signal selection circuitry in a signal reception place.
[Drawing 25] The outline circuit diagram showing the example of composition of a signal adder circuit by the application of the 6th operation gestalt.
[Drawing 26] The outline cross section showing the example of composition of the medical X-ray CT scanner which carried the lightwave transmission system in the 7th operation form.
[Drawing 27] Outline front view which looked at the inside of a stand along with H-H of drawing 26 .
[Drawing 28] Outline front view which looked at the inside of a stand along with I-I of drawing 26 .
[Drawing 29] Outline front view showing the composition of the lightwave transmission system in an octavus operation gestalt.
[Drawing 30] The outline side elevation seen along with J-J of drawing 29 .
[Drawing 31] (a) - (d) is drawing showing the concept of the example of arrangement of the plane mirror common to each operation gestalt.
[Drawing 32] (a) And (b) is drawing showing the concept in the case (a plane mirror is one sheet) of having arranged two or more ideal points.
[Drawing 33] (a) And (b) is drawing showing the concept in the case (a plane mirror is two sheets) of having arranged two or more ideal points.
[Drawing 34] Drawing showing the concept at the time of devising arrangement of a light emitting device and a photo detector with the conventional technology.
[Drawing 35] Drawing showing the concept in the case of having arranged the concave mirror with the conventional technology.
[Description of Notations]
1 Body of Revolution
2 Fixed Object
3 Transmitting System
4 Receiving System
5 Signal Transmitting Origin
6 Laser Beam Discharge Section
7 Light-receiving Section
8 Signal Reception Place
9 Plane Mirror

10 Photo Detector
P1 Ideal point
P2 Convergent point

[Translation done.]

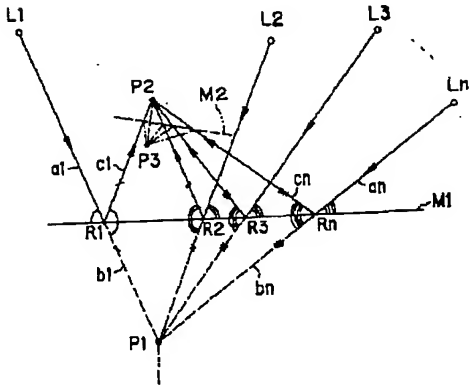
DRAWINGS

[Drawing 1]

[Drawing 2]

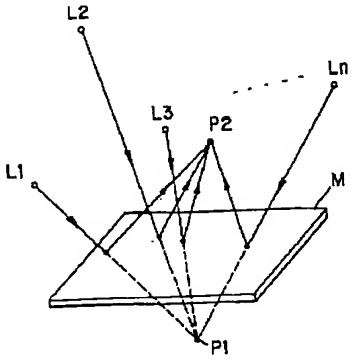
[Drawing 3]

Drawing selection drawing 1



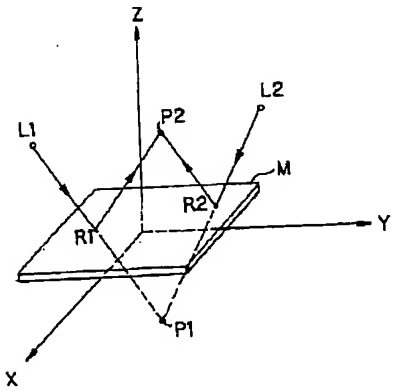
[Translation done.]

Drawing selection drawing 2



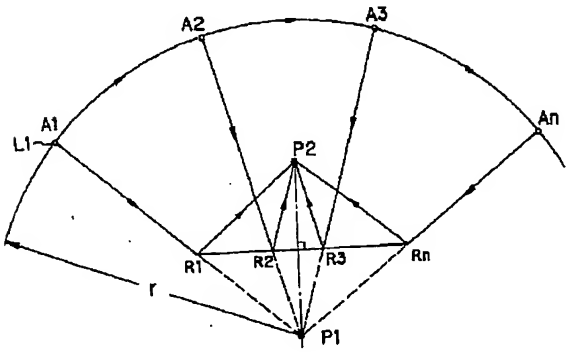
[Translation done.]

Drawing selection drawing 3



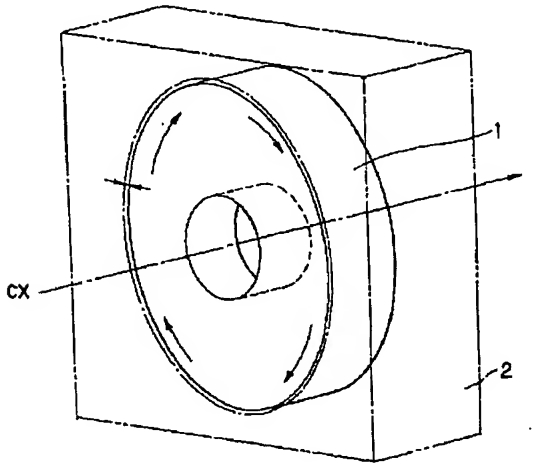
[Translation done.]

Drawing selection drawing 4



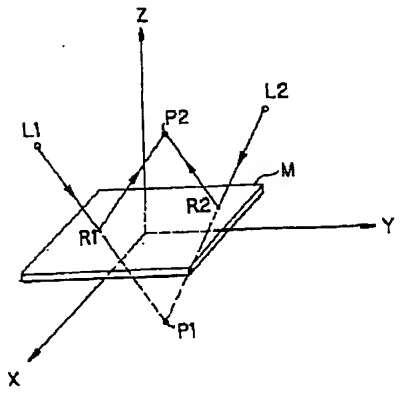
[Translation done.]

Drawing selection drawing 5



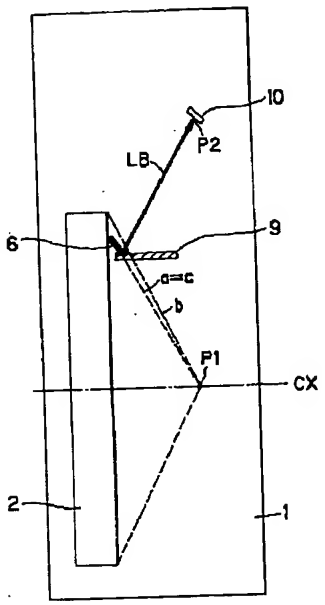
[Translation done.]

Drawing selection drawing 6



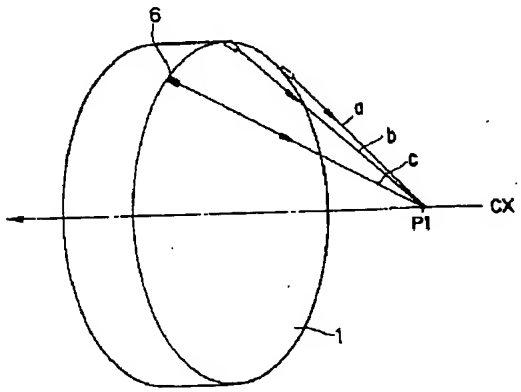
[Translation done.]

Drawing selection drawing 7



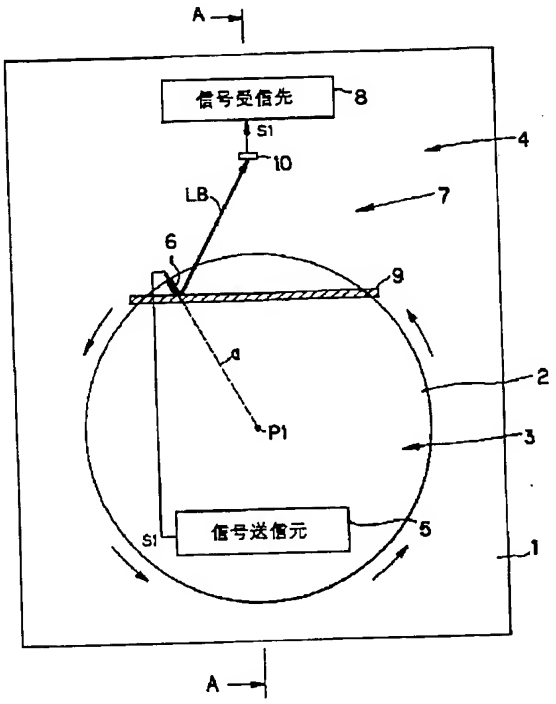
[Translation done.]

Drawing selection drawing 8



[Translation done.]

Drawing selection drawing 6



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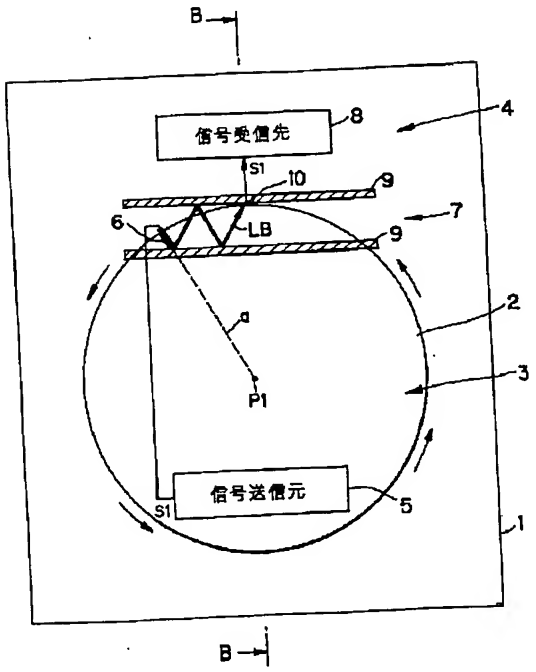
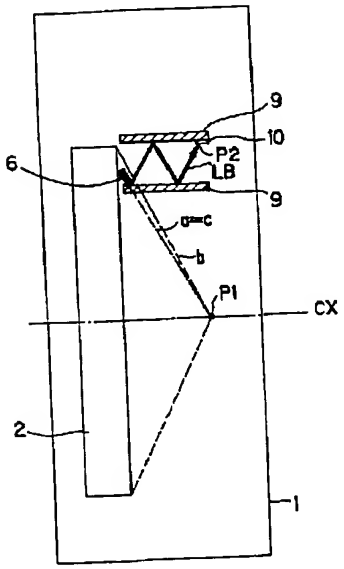
Drawing selection drawing 9



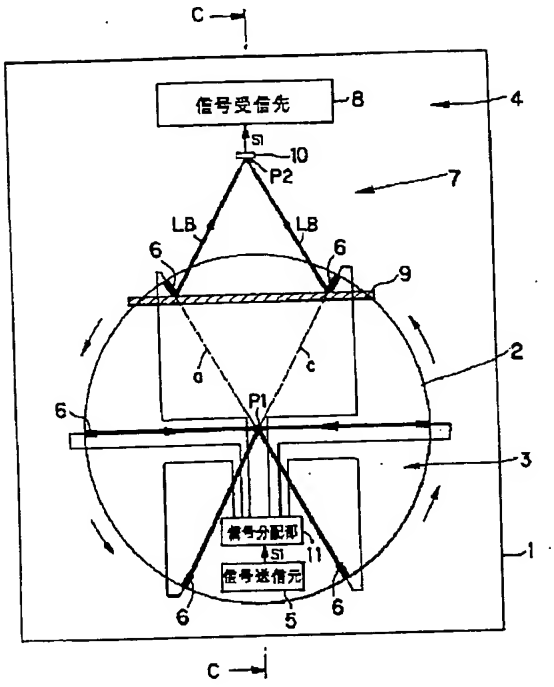
[Translation done.]

Drawing selection drawing 10



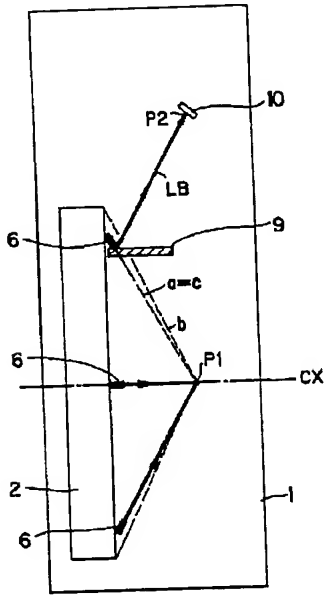
[Translation done.]

Drawing selection drawing 11



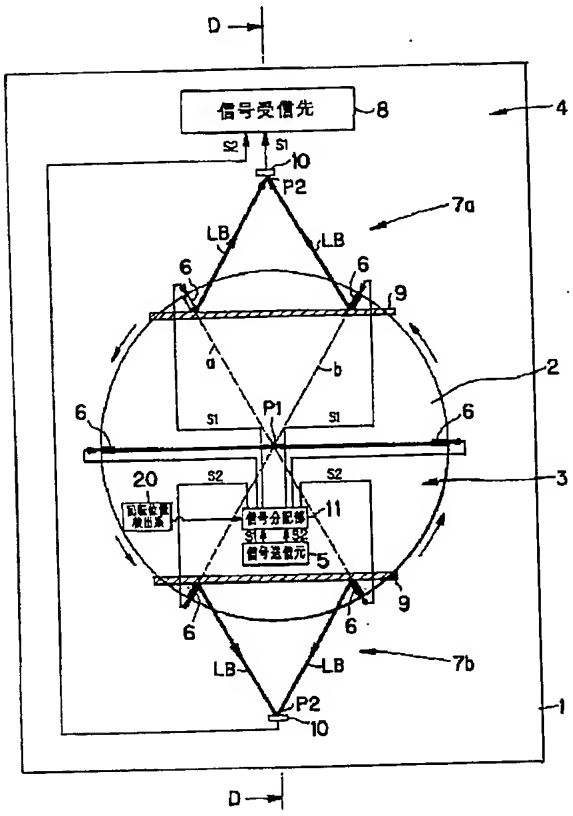
[Translation done.]

Drawing selection drawing 12



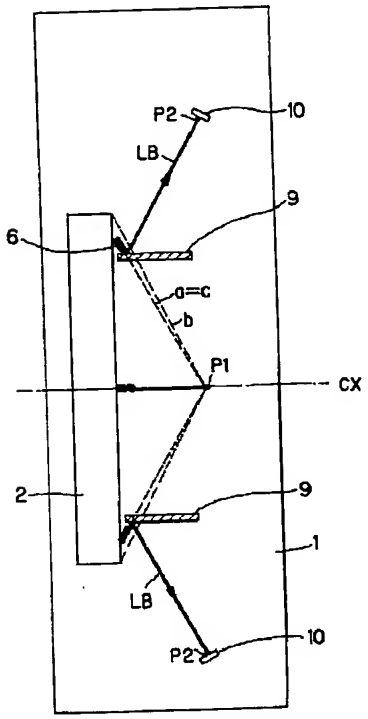
[Translation done.]

Drawing selection drawing 13



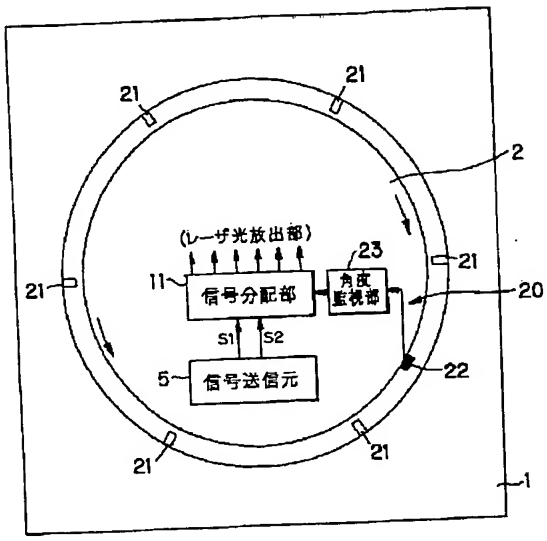
[Translation done.]

Drawing selection drawing 14



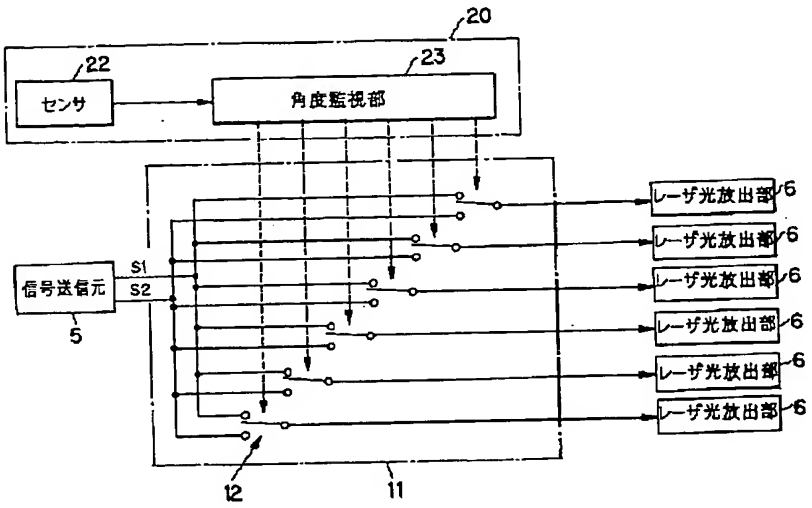
[Translation done.]

Drawing selection drawing 16



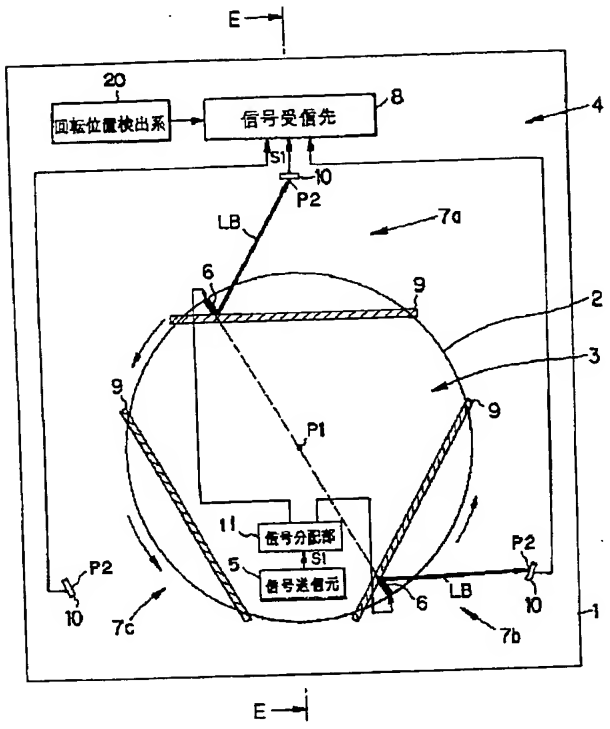
[Translation done.]

Drawing selection drawing 15



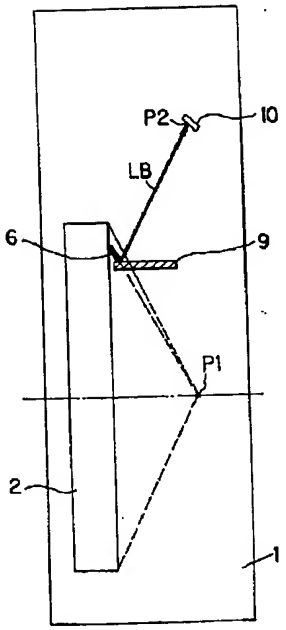
[Translation done.]

Drawing selection drawing 17



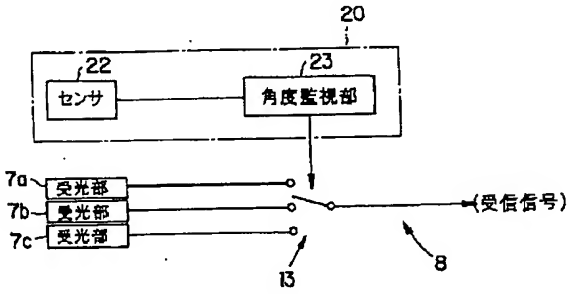
[Translation done.]

Drawing selection drawing 18



[Translation done.]

Drawing selection drawing 19



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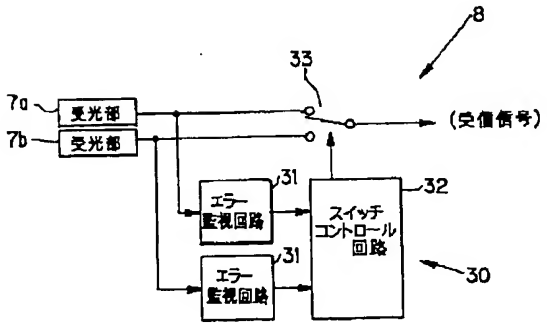
Drawing selection drawing 24



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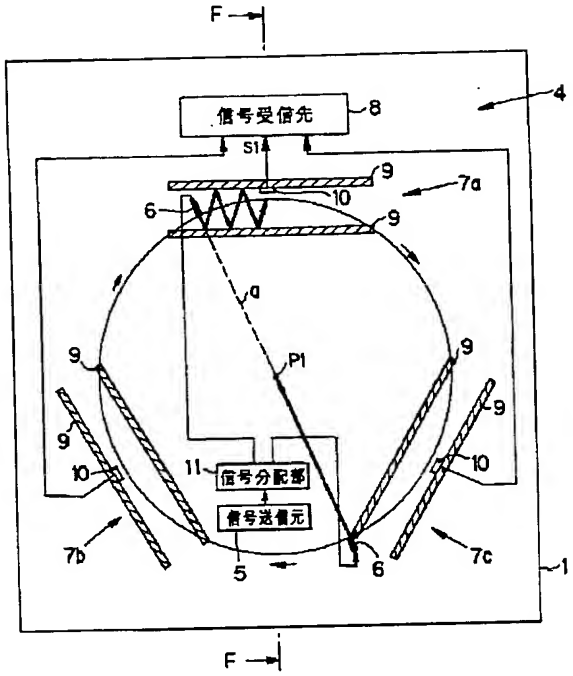
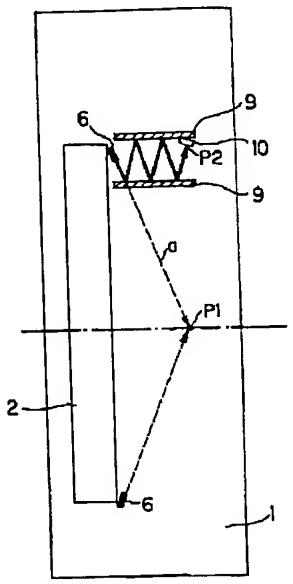
Drawing selection drawing 20



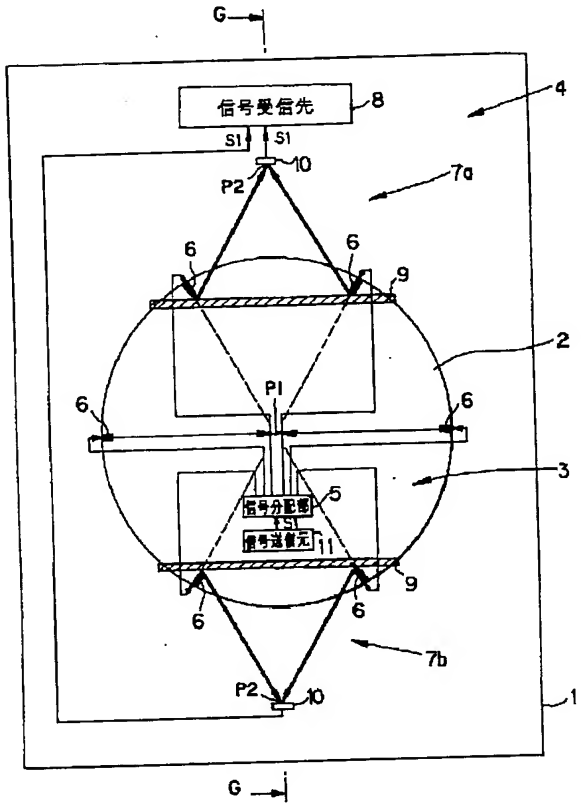
[Translation done.]

Drawing selection drawing 21



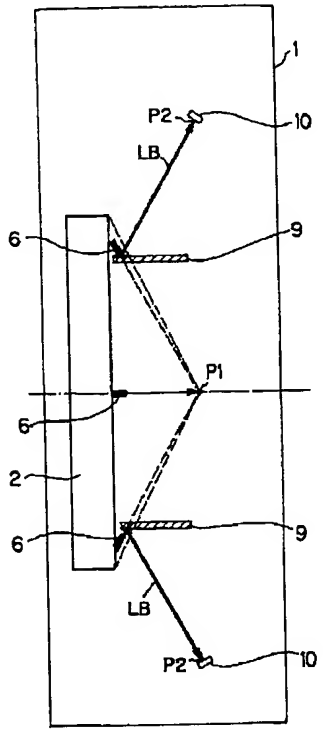
[Translation done.]

Drawing selection drawing 22



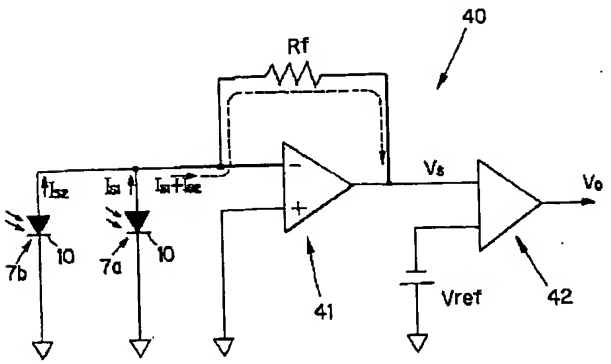
[Translation done.]

Drawing selection drawing 23



[Translation done.]

Drawing selection drawing 25



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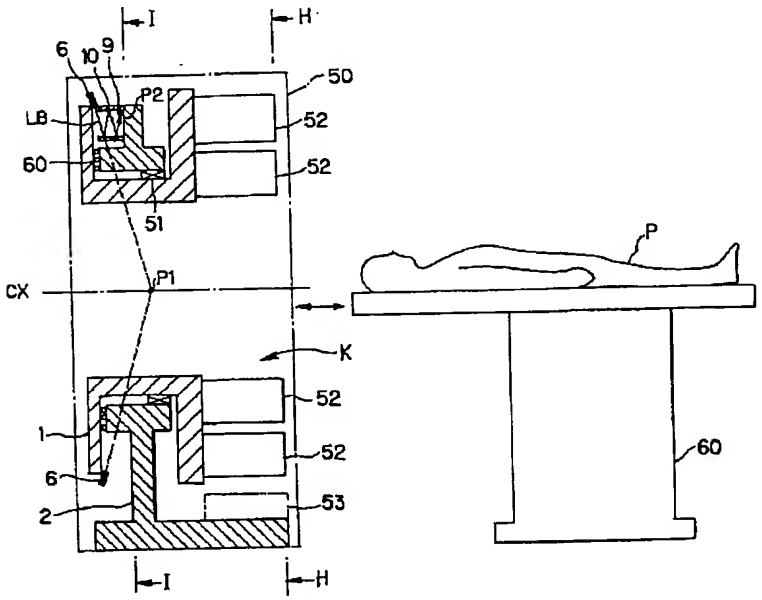
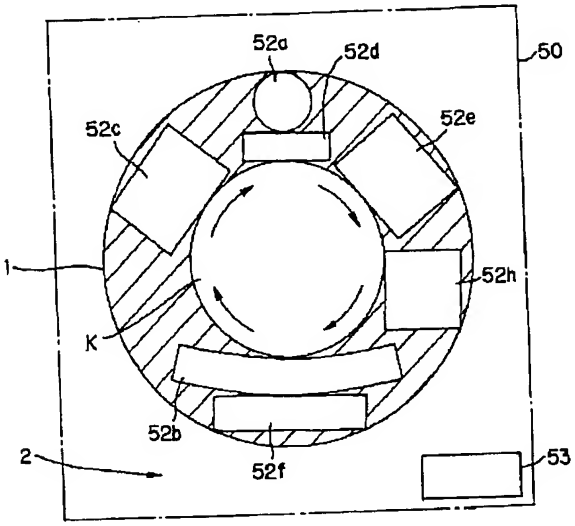
Drawing selection drawing 26



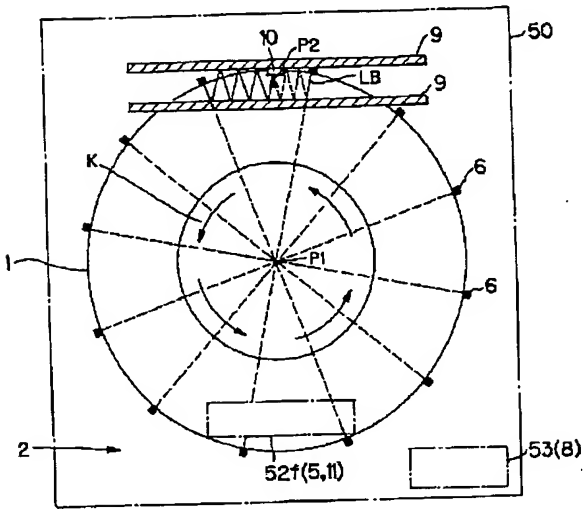
[Translation done.]

Drawing selection drawing 27



[Translation done.]

Drawing selection drawing 28



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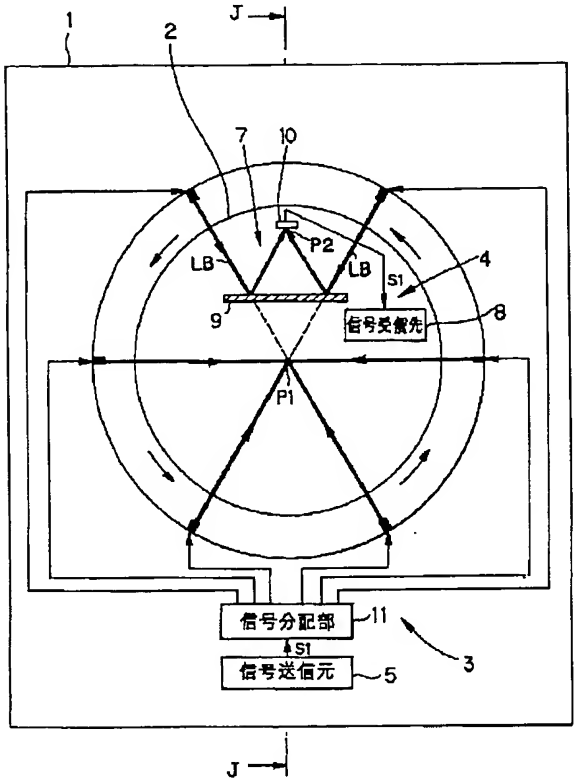
Drawing selection drawing 29



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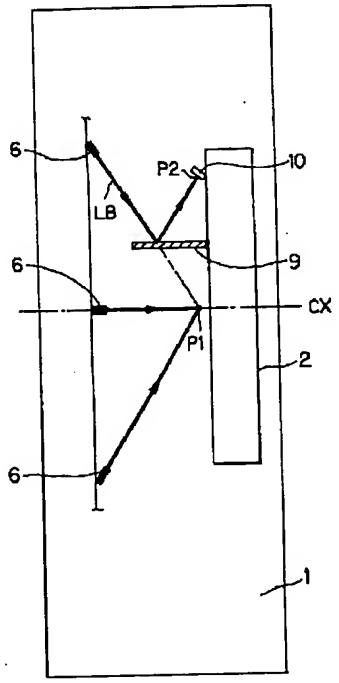
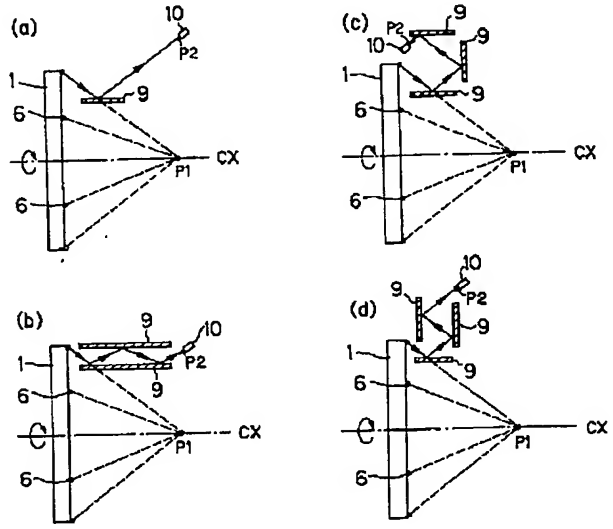
Drawing selection drawing 30



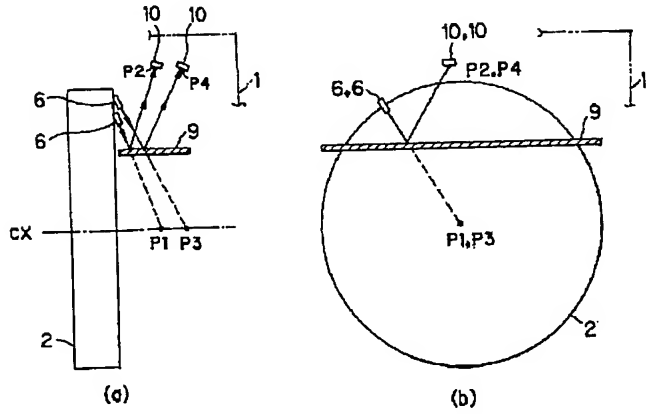
[Translation done.]

Drawing selection drawing 31



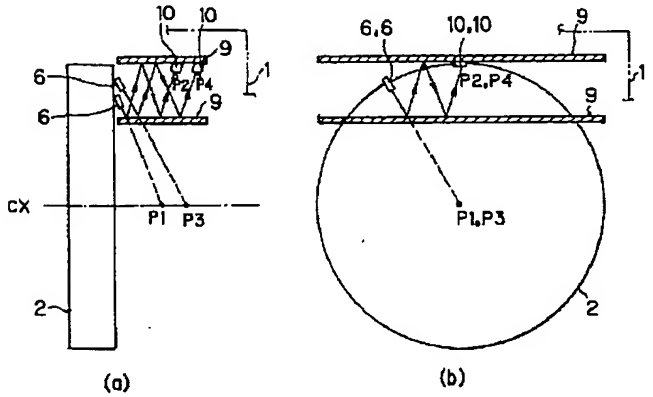
[Translation done.]

Drawing selection drawing 32



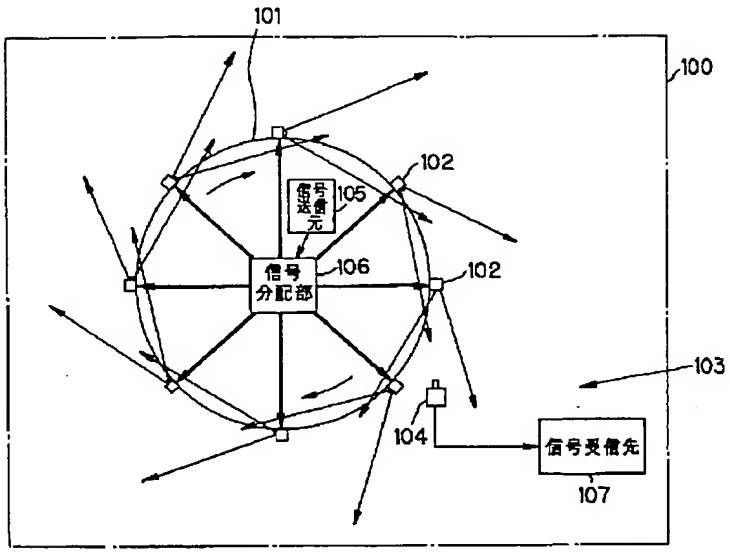
[Translation done.]

Drawing selection drawing 33



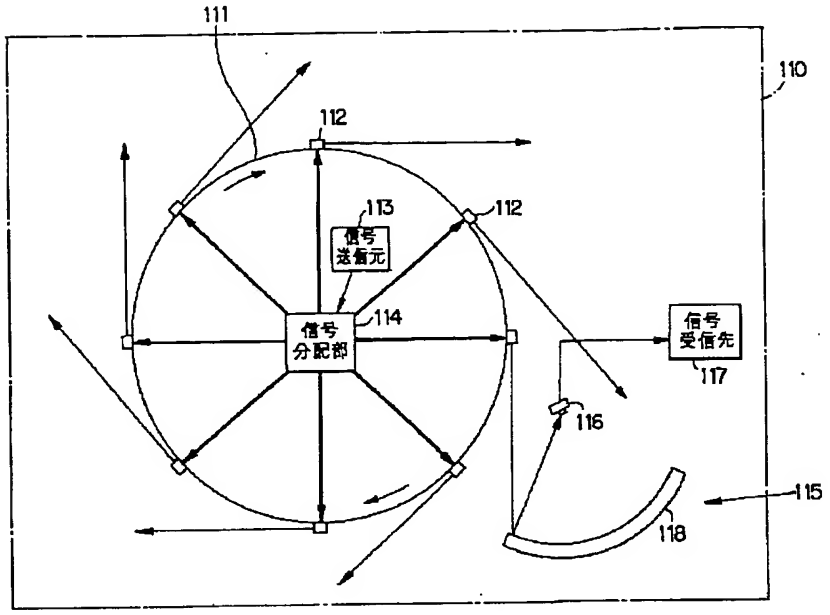
[Translation done.]

Drawing selection drawing 34



[Translation done.]

Drawing selection drawing 35



[Translation done.]